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A study of the effects of inadequate nutrition upon disadvantaged children involved 113 Head Start children and their families. Information was collected on home diet, socioeconomic data, performance on intelligence tests, hemoglobin levels, class attendance, height, and weight to find out whether or not there was a relationship between nutrition and behavior. Since adequate nutrition enables one to cope better with stresses, it is probable that a satisfactory diet can positively influence behavior. Results indicate that high amounts of refined carbohydrates and low amounts of meat are associated with low playground activity, hyperactivity and short attention spans. Children with small amounts of vitamin A had lower playground activity, less hyperactivity, and longer attention spans. Specific measures need to be designed to test the relationships between diet and behavior. "The Relationship Between Hemoglobin Level and Intellectual Function" (PS 001 723), by the same author, is a shorter report on the same subject. (MS)

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A STUDY OF FOOD AND POVERTY AMONG 113 HEAD START CHILDREN IN MISSOULA, MONTANA

PART I	INTRODUCTION: POVERTY CAKE
PART II	A MODEL FOR THE CYCLE OF MALNUTRITION AND POVERTY
PART III	A DESCRIPTION OF HEAD START FAMILIES, WITH EMPHASIS ON ASPECTS OF A MALNUTRITION-POVERTY CYCLE

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PART I POVERTY CAKE

A Head Start mother proudly gave me, the Head Start nutritionist in Missoula, Montana, this recipe for Poverty Cake to share with other mothers. It symbolized the problems of nutrition among the Missoula poor.

A. It tastes good; children enjoy eating it.

B. It symbolizes sweetness and love. The mother who bakes it feels she is being a good mother.

C. It supplies quick energy to tired people.

D. It is immediately rewarding, emotionally and physiologically. One mother who spends 20¢ a day per person for food says this is the most satisfying food she can give her family.

E. Because it is rewarding, the eating of cake reinforces the eating of cake. This most basic reinforcement promotes the pattern of eating refined carbohydrates.

F. It saves money: no milk, (dried milk is cheap, but water is free). No eggs. Sugar, fat and flour are cheap sources of calories.

I have a cake recipe. Call Poverty Cake. It is sure good.

3 cups all purpose flour
2 cups sugar
6 heaping teaspoon coca
2 teaspoon soda
1 teaspoon salt
2 teas vanillia
2 tablespoon vingar
12 tablespoon oil
2 cups water.

Mix dry ingredients in 9 X 13 pan. Make 3 holes. Oil in one - vinger in one - vanillia in third. Pour in water. Stir & back at 350°. 35 to 40 mins.

OBSERVED MALNUTRITION AMONG THE DISADVANTED

Poverty cake, macaroni, crackers and other easily prepared, easily eaten refined carbohydrates compete successfully with dried beans for popularity, although dried beans are a cheap source of protein, minerals and vitamins. Dandelion greens at no cost provide 14,000 IU of vitamin A per half cup. Liver is a good buy of nutrients but is a waste of money if no-one eats it. Beans, greens and liver do not give immediate satisfaction in either sweetness or quick energy. Nor do we hear on TV that "Things go better with liver."

In the three years I have worked as nutritionist for Head Start, I have observed that many Head Start mothers did not accept the Four Basic Food Groups or the Low Cost Food Plan developed by the Department of Agriculture as practical standards. They could not afford, or felt they could not afford those foods. By definition, Head Start families have less money than that needed to buy the necessities of life. Eligibility for the program depends on having incomes below the poverty level. Since in the cold climate of Missoula, a warm house and warm clothes are immediately necessary for survival, the money spend for food must be cut with resultant less-than-optimum nutrition. Missoula has no commodity program or Food Stamp Program.

THE POSSIBILITY OF A MALNUTRITION - POVERTY CYCLE

Was this observed less-than-optimum nutrition related to the children's performance in school? In "A Study of the Relationship Between Hemoglobin Level and Mental Performance," no evidence was

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found that fall hemoglobin levels were significantly related to fall intelligence test scores or teachers' ratings of behavior. The evidence did suggest that changes in hemoglobin levels among those who began with levels below 12.0 gms % were associated with changes in IQ: the correlation was .74. Hemoglobin levels did not change differently in the groups of children who received 60 mg ferrous sulfate at school daily and those who received placebos. There was no evidence indicating the cause of the change in hemoglobin.

This study raised several questions: was iron in home diets related to hemoglobin level? What, if not iron, did cause low hemoglobin levels?

Since hemoglobin transports oxygen, some low level of hemoglobin must have hypoxic effects. However, in hypoxia there is first a lowering of the threshold of excitability and then a progressive failure of irritability. (1) This would make measurements of effects difficult: averages of activity would be useless.

Gelhorn _et al_ have suggested that hypoxia and hypoglycemia have a similar physiologic action on the central nervous system and that they act synergistically in the production of convulsive seizures. (2) Sugar and Gerard have also suggested that hypoglycemia acts much like hypoxia on the function of the brain, since it leads to interference with oxidation in that organ. (3) Then hemoglobin levels cannot be considered without also considering nutrients that influence blood sugar levels and oxidation.

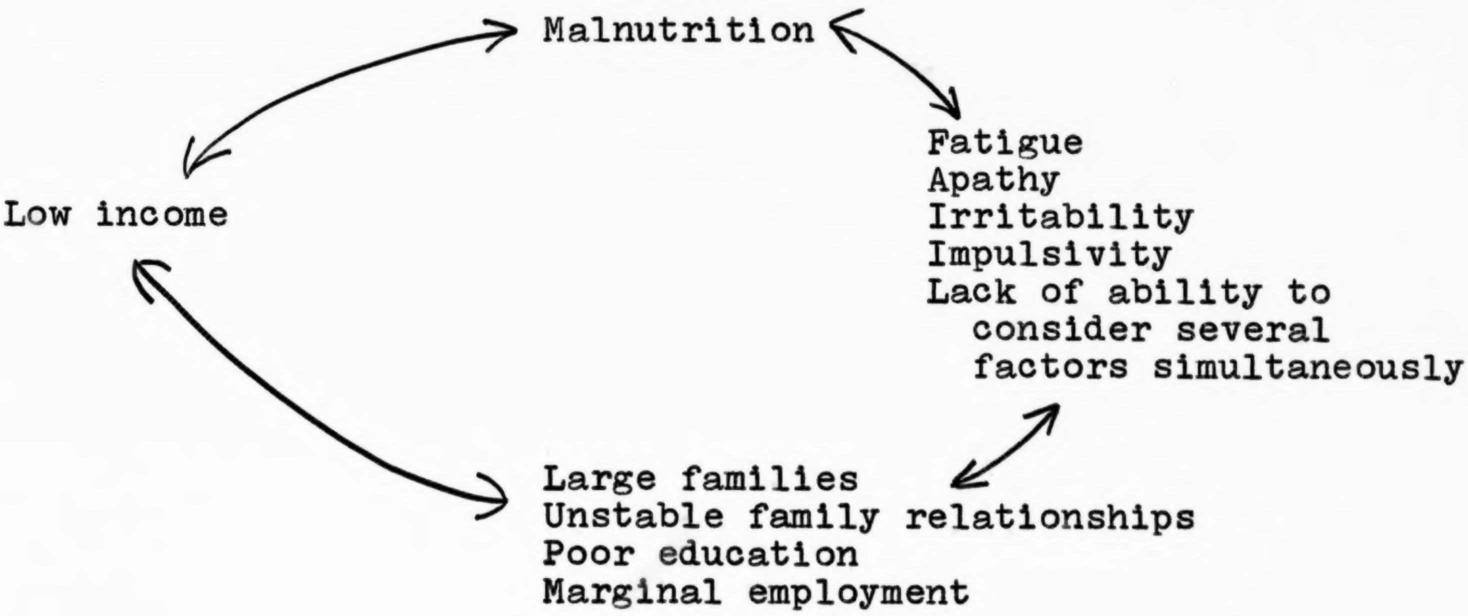
Frontal lobe function is particularly sensitive to hypoxia. Then any nutritional deficiency that interfered with cerebral oxidation would, theoretically, handicap frontal lobe function.

The syndrome of poverty is similar to the syndrome of frontal lobe dysfunction (as documented in Table I.) The syndrome of poverty includes behavior frequently described as typical of many low income people: impulsive, seeks immediate gratification, lacks goal committment, responds to immediate, tangible and concrete rather than the abstract, categorical and relational properties, and lacks self-criticism. While these differences are marginal, subtle and not universal among the disadvantaged, and are definite in frontal lobe dysfunction, the similarities are of a magnitude that demands investigation. These differences could be caused by any malnutrition that affected cerebral metabolism.

Therefore a hypothesis of this study is that the syndrome of poverty has as one of many causes a physiological handicap caused by malnutrition.

Poverty Cake is not deficient in a single nutrient only. Deficiencies of the poor, as of the middle class, are often multiple. To define what behavior may be expected to be influenced by which deficiencies, the roles of various nutrients are summarized. Malnutrition is associated with irritability and at the same time with apathy and fatigue. The catecholamines, serotonin and acetylcholine that influence emotional responses and brain excitability are produced by enzymes of which specific vitamins are a part. In undernutrition is a diminution of all drives except a drive to satisfy some of the more elemental forms of pleasure. (4)

Thus part of the poverty syndrome can be theoretically explained in terms of malnutrition. There may be a malnutrition-poverty cycle:



Malnutrition

Fatigue
Apathy
Irritability
Impulsivity
Lack of ability to
  consider several
  factors simultaneously

Large families
Unstable family relationships
Poor education
Marginal employment

Low income

Not all of the disadvantaged are malnourished. Some mothers give their families excellent low cost diets. And some children are apparently thriving on apparently inadequate diets. Individual requirements of nutrients vary greatly. Perhaps children with adequate diets or more effective utilization are better able to get out of the poverty cycle.

The disadvanted are of course handicapped by more than malnutrition. They are handicapped by the degradation of poverty, the hopelessness, alienation, poor education and inadequate housing. Adequate nutrition does not eliminate these.

However, with adequate nutrition, one can cope better with the stresses. Just as inadequate nutrition does not cause infection, but enables the body to fight infection, so the levels of nutrition commonly found in the United States may not directly cause poverty. Less than adequate nutrition handicaps the ability of the poor to cope with environmental problems. Gomez Mont describes adulthood undernutrition: "Adaptation to decreased food intake is so great that people are able to carry on during this period and even to do heavy physical work when daily obligations force them to do so. If there is no need for physical exertion, they will do as little as possible....The undernourished family can survive under these conditions for long periods of time, masking a very unstable equilibrium ready to break in the presence of any stress." (4)

For example, an irritable child with lack of ability to keep his attention directed toward a goal, lack of ability to consider several factors simultaneously and without ability to delay response would react to a punishing teacher by dropping out of school. A less impulsive child who was able to correlate more information might stay in school and avoid behavior that precipitated the punishment. In either case the punishing teacher, and the poor education are handicaps, stresses that the well-nourished child can handle better than the poorly nourished child.

The parable of the straw that broke the camel's back is illustrative. With poor nutrition the camel has a weak back. The environment of the disadvantaged piles on straws of stress. With the combination of weak back and one too many straws, the camel collapses. The weak back is not disabling without a heavy load; the heavy load is not disabling with a strong back. Our task must be to strengthen the disadvantaged as well as to reduce their burdens.

Part II presents the Malnutrition-Poverty Cycle and the rationale behind it.

DOES NUTRITION INFLUENCE BEHAVIOR?

Does this cycle really exist; if so, to what extent? To establish that the behavior of the disadvantaged has a physiological handicap that is caused by (among other things) malnutrition, it is necessary to establish that:

A. Malnutrition affects intellectual function

B. Malnutrition exists among the disadvantaged

C. This level of malnutrition is actually related to some function or behavior.

Therefore a survey of home diets was made. Hemoglobin levels were determined. Teachers rated behavior. WPPSI and Lorge Thorndike Intelligence Tests were given. Heights and weights were recorded.

The effects of malnutrition cannot be isolated from the effects of the rest of the environment. Therefore socio-economic data were collected and attendance at school recorded. It was intended to look for relationships among these variables. The problem was complex. However, this data provides a description of poverty among Head Start families in Missoula. It also provides insights about types of malnutrition and the behavior that may be associated with them. These are discussed in Part III.

PART II

A MODEL FOR THE CYCLE OF MALNUTRITION AND POVERTY

In the education and sociological literature about the disadvantaged, a syndrome of poverty is usually explained in terms of the attitudes of the subculture and of the social environment. For instance Deutsch (5) wrote:

> "There is much emphasis [on cognitive effects] at the present time...The current emphasis comes from the observation of the types of cognitive deficits that the disadvantaged child shows at the time of school entrance. Both these observations and the research showing that absence of early stimulation is extremely detrimental to the development of function have led to interest on the part of researchers in identifying the aspects of the disadvantaged environment that contribute to particular deficits in cognitive functioning and in skills basic to school success. The research on the effects of the absence of stimulation includes, for example, experiments in sensory isolation, and in early visual stimulation."

Young (6) writes about the attitudes of the subculture:

> "When the children of poverty reach the classroom of the public school, they bring with them not only limitations of knowledge and experience, but, more fundamental, attitudes toward learning, and conceptions of the dominant group that are serious obstacles to achievement... Disorganized families lack the compass of purpose, of a clear goal. Their horizon tends to be not next year or even next month, but today's sunset. Without the orientation of purpose, planning becomes largely irrelevant. If there is no image projected on the screen of the future, there is nothing to plan for. Without planning there is much less incentive for positive action and consequently less resistance to the actions of impulse -- those actions that translate the emotion of the moment into behavior that at best dissipates energy to little purpose, and at worst is destructive both to the actor and to his immediate surroundings. As a way of life it has within itself disintegrating tendencies.
>
> Along with its proneness to impulsivity, lack of purpose promotes passivity. This may seem a paradox, but the two qualities are in fact complementary. Without consistent direction and planning, problems, whatever they may be, are allowed to develop into overwhelming proportions and are felt by the individual as calamities that happen to him. He has no control over them and except for impulsive and largely ineffective attempts to escape their impact, he sees little recourse but to let them roll over him."

Impulsivity, passivity, defects in cognition, and lack of purpose and planning are described as the result of poverty and the poverty subculture. The model here presented integrates these factors as part of a cycle. Impulsivity, passivity, etc. are considered as a partial cause of poverty as well as being one result. Physiological handicaps in mental function do cause similar symptoms of impulsivity, apathy, fatigue and irritability. The physiological handicaps may result from chronic or severe untreated illness or inadequate prenatal and natal care. The physiological handicaps considered in this section are nutritional in origin.

The poverty syndrome is similar to behavior at high altitudes where higher brain functions are handicapped. It is similar to the behavior in frontal lobe dysfunction. Similar symptoms can be, and have been, precipitated by nutritional deficiencies, and corrected with adequate diets. These similarities are presented in Table I.

Sources for Table I
Characteristics of the disadvantaged quoted from:
- Milly Cowles, Perspectives in the Education of Disadvantaged Children. New York: World Publishing Co. 1967
- Staten W. Webster, The Disadvantaged Learner. San Francisco: Chandler Publishing Co. 1966
- Lester D. Crow, Murray, Walter and Smythe, High, Educating the Disadvantaged Child. New York: McKay Co. 1966
- Elizabeth Herzog, About the Poor. Washington: Children's Bureau, U.S. Government Printing Office, 1967

Characteristics of Frontal Lobe dysfunction:
- Arthur C. Guyton, M.D. Medical Physiology. Philadelphia: W. B. Saunders Co. 1961

Characteristics of Hypoxia:
- Edward J. Van Liere and Clifford Stickney, Hypoxia. Chicago: University Chicago Press 1963
- Philip Bard, Medical Physiology. St. Louis: C. V. Mosby Co. 1961

TABLE I

CHARACTERISTICS OF THE DISADVANTAGED AND OF MENTAL DYSFUNCTION

Characteristics of the Disadvantaged	Characteristics of Frontal Lobe Dysfunction	Characteristics of Hypoxia
Hyperactivity Impulsivity Irritability Distractibility	Hyperactivity Impulsivity Irritability Distractibility	Lowering of threshold of excitability Resentment Distractibility
Seeks immediate gratification Lack of goal committment Orientation toward the present Aspires to immediate gratification of desires Often uses force rather than reason	Loss of ability to delay response Loss of ability to keep mental function directed toward a goal	Emotional outbursts
Do not see all sides of an issue Human behavior is seen as unpredictable and judged in terms of immediate impact Inferior judgement concerning time, number and other basic concepts	Loss of ability to store bits of information and correlate them into thoughts of the highest order Loss of ability to correlate all avenues of information	Mental confusion and Loss of judgement Changes in integrative action of the nervous system
Holds the world, not himself, responsible for his misfortunes; consequently he is much less apt to suffer pangs of self-blame and can be more direct in his expression of aggression Responds to the concrete, tangible, immediate and particularized properties of objects and situations rather than to their abstract, categorical and relational properties	Loss of ability to plan for the future	Lacks self-criticism Blunted sensibilities Sense of power Self-satisfaction Euphoria Powers of introspection, discrimination and logic affected.
Fatalistic, subjective attitudes; magical thinking	Loss of ability to control one's activities in accordance with moral law	
Persevering rather than flexible Definite, intense convictions and difficult to move		Fixity of purpose
Passive attitude Apathy		Depression, apathy

RELATIONSHIP BETWEEN HYPOHEMOGLOBINEMIC HYPOXIA AND HIGH ALTITUDE HYPOXIA

The effects of hypoxia due to lowered hemoglobin levels on cortical function are similar to effects of hypoxia due to high altitudes. Regardless of the dynamics of its development, or even the tissue affected, it is probable that the mechanism of the disruptive actions of anoxia is the same in all forms not involving poisoning of tissue enzymes, (7).

Pertinent studies are cited in the Handbook of Physiology (8):

> Reduction in cerebral oxygen consumption has been reported in various chronic anemias and in pernicious anemia...Successful treatment of the pernicious anemia only partially restored the normal metabolic rate, evidence either of an irreversible effect of a prolonged oxygen deficiency in the brain or of some other intracellular effect of the disease quite independent of the anemia. Changes in mental function closely paralleled the changes in cerebral oxygen consumption. It must be pointed out, however, that the reduction in cerebral oxygen consumption observed in the anemias may be the result of a methodological error in the application of the nitrous oxide technique.

In malnutrition, the cardiac output does not compensate for anemia: Bradycardia is one of the more constant findings in severe malnutrition and was notable in studies in Europe during and after the two World Wars. In the Minnesota experiment, the cardiac output for the 32 men was reduced to 55% of the control value at the end of semistarvation. (9). At this time their average hemoglobin levels were 11.7 ± .8 gm. These levels are similar to those of the low hemoglobin group of the Missoula Head Start children.

According to Bard (10) when generalized anoxia occurs, the order in which the different components of the central nervous system fail follows roughly the same order of "descending depression" seen with increasing doses of a narcotic drug. Those parts with the highest metabolism are first affected.

Van Liere and Stickney in a survey of the literature on hypoxia (11) report:

> A person exposed to low-oxygen tension often passes through an initial stage of euphoria, accompanied by a feeling of self-satisfaction and a sense of power. The oxygen want stimulates the central nervous system so that the subject may become hilarious and sing or shout, and manifest other emotional disturbances.
>
> After a certain length of time this initial stimulation is followed by depression; emotional outbursts of a different nature appear; and the personality frequently changes for the worse. Hilarity gives way to moroseness and quarrelsomeness, and the person may become pugnacious or dangerously violent.
>
> Hypoxia quickly affects the higher centers, causing a blunting of the finer sensibilities and a loss of judgement and of self-criticism. The subject feels, however, that his mind is not only quite clear but unusually keen. He developes a fixity of purpose and continues to do what he was doing when hypoxia first began to affect him, in spite of the fact that it may lead to disaster. This fixity of purpose is highly dangerous, especially when such an individual is responsible for the lives of others, such as is true of an airplane pilot.
>
> Individuals who suffer from oxygen want and who manifest a fixity of purpose often make no effort to remove themselves from a zone of danger.

FRONTAL LOBE SENSITITIVITY TO HYPOXIA

Morrison (12) made comprehensive histologic observations on 25 dogs and 10 monkeys which had been subjected to various degrees of hypoxia. Repeated exposures of moderate hypoxia (12-13 volumes of oxygen in the blood) showed that the first histologic changes occured in the cell bodies of the cortical gray matter. During severe hypoxia, the frontal lobe was most often, and the temporal lobe least often, involved.

In cats no neuronal damage occurred after ischaemia lasting less than three minutes, but when the ischaemic period was extended to 3 1/2 minutes then neurones in frontal and occipital cortex were destroyed. Successively longer periods of ischaemia first killed the remainder of the cortical neurones, and then those of the basal ganglia, while the medullary neurones were most resistant (13). One of the diagnostic pathological features of anoxic brain injury is that certain groups of neurones appear to be especially susceptible and are selectively destroyed by oxygen deprivation. These include the nerve cells of the hippocampus, layers II and III of the cerebral cortex, and the basal ganglia. (14)

The duration of hypoxia is a factor in its effect. Twenty percent carboxyhemoglobin represented an anoxia too mild to elicit any acute symptoms in dogs. After about three months of daily exposure to maintain 20% carboxyhemoglobin, dogs showed signs of degenerative changes in the cortex and basal ganglia of the brain, which was confirmed by postmortem examination. There were lesions similar to those produced by very actue anoxia . (15)

SIMILARITIES BETWEEN FRONTAL LOBE DAMAGED BEHAVIOR AND HYPOXIA-ALTERED BEHAVIOR

Those changes in cerebral function due to high altitude hypoxia are similar to descriptions of impaired frontal lobe function and to descriptions of malnutrition syndrome and of low income sub-cultures.

Guyton (16) describes the function of the frontal lobes:

> One of the outstanding characteristics of a person who has lost his frontal lobes is the ease with which he can be distracted from a sequence of thoughts. Likewise, the ability of lower animals whose frontal lobes have been removed to concentrate on psychological tests is almost completely lost. The human being without frontal lobes is still capable of performing many intellectual tasks, such as answering short questions, performing simple arithmetic computations, and so forth, thus illustrating that the basic intellectual activities of the cerebral cortex are still intact without the frontal lobes. Yet, if concerted sequences of cerebral functions are required of the person, he becomes completely disorganized. Therefore, the frontal lobes seem to be important in keeping the mental functions directed toward goals. Here again, though, this may not be a specific function of the frontal lobes, but it may be simply that this extra mass of cortex supplements the remainder of the cortex to a sufficient extent that

distractibility will not result.

Another function that has been ascribed to the frontal lobes by psychologists is that called elaboration of thought. This means simply an increase in depth and abstractness of the different thoughts. It can be shown by psychological tests that lower animals presented with successive bits of sensory information will forget these bits, however important they may be, within a second or more if the prefrontal lobes are removed. Yet, if the prefrontal lobes are intact, many successive bits of information can be remembered for many seconds. Therefore there is much reason to believe that the prefrontal lobes are especially capable of storing many bits of information for temporary periods of time and then correlating these into thoughts of a very high order. This ability to hold and correlate many types of information simultaneously in the frontal lobes could well explain the many functions of the brain that we associate with the prefrontal lobes, such as the abilities (1) to plan for the future. (2) to delay action in response to incoming sensory signals so that the sensory information can be weighed until the best course of response is decided, (3) to consider the consequences of motor actions even before these are performed, (4) to solve complicated mathematical, legal or philosophical problems, (5) to correlate all avenues of information in diagnosing rare diseases, and (6) to control one's activities in accord with moral laws.

The person without prefrontal lobes ordinarily acts precipitously in response to incoming sensory impulses, such as striking an adversary too large to be beaten instead of running away. Also, he is likely to lose many or most of his morals; he has no embarrassment in relation tohis excretory, sexual and social activities; and he is prone to quickly changing moods of sweetness, hate, joy, sadness, exhileration, and rage. In short, he is a highly distractible person with lack of ability to pursue long and complicated thoughts.

HYPOXIA-CAUSED STIMULATION

It was shown by Thorner and Brink that if the human ulnar nerve is deprived of its circulation for thirty minutes, there is first a lowering of the threshold of excitability and then a progressive failure of irritability. (17)

Gerard reported on the response of the nerve fiber to oxygen lack. He found that in the course of asphyxia, action potentials first rise and then fall to zero. (18)

Lehmann, working with excised nerves of the cat under controlled conditions of hydrogen ion concentration, found that when they were immersed in pure nitrogen, a typical sequence of irritability occurred. There was a lowering of the threshold of excitability first, followed by a progressive failure of irritability of the nerve fiber. The after-potentials disappeared before the spike (19).

Armstrong and Heim subjected rabbits for four hours daily to simulated altitude of 18,000 feet. They first noted hypertrophy of the whole adrenal gland and later observed degenerative changes in the cortex. Armstrong suggested the possibility that the fatigue seen in altitude sickness might be related to adrenal insufficiency or exhaustion. (20)

Bagby (21) reports that hypoxia increased the subject's distractibility, so that a marked reduction developed in the ability to simultaneously carry on a number of discrete tasks. When the hypoxia became severe, the subject was unable to concentrate on any task in a normal manner.

Disruptions in cerebral metabolism could be related to hyperactivity, impulsivity, distractibility, impulsivity, and ability to respond to abstract, categorical and relational properties.

BEHAVIOR CHANGES IN MALNUTRITION

The science of nutrition is in the paradoxical state of having demonstrated that deficiencies of specific nutrients cause drastic changes in physiological function and in behavior, but of having only meager evidence that behavior of groups of people has been influenced by malnutrition. Individuals testify that they function better when anemia is treated. Psychotic pellagrins have been treated with nutrients and released from institutions. Yet there are few objective, standardized studies of the relationship between nutrition and behavior or intellectual function of groups.

There is a great range in sensitivity of various enzymes to deficiencies, and in differences in the effect of deficiency in various tissues. (22). Individual variations in experimental animals and in man are clearly attested as involving five-fold differences in requirements and in isolated cases the differences may be forty-fold. (23). Thus while many metabolic functions of many nutrients are known, the assumption cannot be made that a specific deficiency will result in specific handicaps for any one individual. Also, the standards based on average requirements can not be applied with certainty to any individual. Some people on adequate diets feel better when supplements are added.

This individual variation in requirements may partially explain why some people can break out of the cycle of poverty while others from the same environment remain trapped.

To demonstrate the effect of a borderline deficiency, one would need to measure the diet, the person's individual requirements, the environmental stress and changes with changes in diet as well as a measure of his ability and behavior.

> Stoch and Smyth (24) have followed semi-longitudinally two groups, each of 21 Negro children. The essential difference between the two groups was in their states of nutrition, as judged by anthropometric measurements....The results showed that at all ages, concurrently with lower values for height, weight and head circumference, the mean intelligence of the under-nourished group was 22.62 points below the mean of the better-nourished group.

> In six different communities in Mexico and Guatemala, high correlations between deficits in height and weight and motor adaptive developmental scores were found. No association of statistical significance could be demonstrated between mental scores and cash income, crop income, parental education, parental hygiene or type of housing (25).

Kugelmass, Poull and Samuel (26) studied the effects of nutritional improvement on mental performance in normal and retarded children. A total of 182 cases of 2 - 9 years of age were included. Among these, 50 children were classified as "normal malnourished." and 50 more were "normal well nourished". Each group was matched for chronological age, I.Q., and interval between Kuhlman-Binet or Stanford Binet tests. After a period of observation, variable between one and three and a half years, the IQ's of the malnourished group showed an average increase of +18 points in contrast of -0.9 change for the well-nourished group."

Poull (27) reported an average rise of 10 points in IQ for a group of children who were definitely malnourished at the time of the first test, and well nourished at the time of the final test, in contrast to the average zero change in a group who were well nourished through the period under consideration.

Kubala and Katz (28) grouped students (kindergarten through college level) according to ascorbic acid levels. The group with optimum ascorbic acid levels had in the beginning higher IQ levels which did not change upon supplementation with orange juice. The group with less-than-optimum ascorbic acid levels increased 3.54 points IQ upon supplementation with orange juice.

PROTEIN

Proteins function in all activities of living organisms. Enzymes, or essential parts of enzymes, are made of protein. A number of hormones are protein. Amino acids are the building blocks of tissue.

Most of the vegetable or grain proteins are low in some essentials such as lysine, tryptophan, threonine or methionine and therefore would not promote growth satisfactorily when fed by themselves. If a given protein or amino acid mixture does not promote optimal growth because it contains only half the necessary amount of some essential amino acid, doubling the quantity of protein consumed will not promote optimum growth. An excess of certain amino acids not only decreases growth but also produces metabolic disturbances. The sequence and position of the individual amino acid within the animal protein molecule may be more favorable. It is good practice, if possible, that at least a fraction, perhaps one-fourth to one-half, of the daily protein intake be in the form of animal proteins. (29)

The brain does not show any appreciable uptake of protein. The liver and kidneys are most active in removal of protein, while skeletal tissue is less efficient. If enough non-protein calories are provided, the amino acids are used for specific purposes, e.g., the synthesis of oxytocin, enzymes, glutathione or carnosine. The amino acids may also be directly transformed into other physiologically important compounds such as epinephrine, creatine, taurine and many others. (30)

The tissue proteins are not rigid structures but there is a steady give and take between tissue proteins and dietary amino acids. For optimum protein synthesis all constituent amino acids must be present simultaneously and in adequate quantities; the rest of the amino acids which have not been used for protein synthesis are irreversibly metabolized. Excess amino acids can neither be stored in the body nor used for formation of partial building stones. Any delay in supplementation of the missing amino acids decreases utilization so that, when 4 to 6 hours intervene between feeding the incomplete mixture and the missing amino acids, there is detectable interference with protein synthesis. (31)

The first step in the regular pathway of amino acid catabolism is deamination. In this process the basic amino group is split off and thus the amphoteric monoamino acids are transformed into αketo acids. Deamination is an oxidative process and the elimination of two $-NH_2-$ groups requires the uptake of 1 mole of oxygen. The deamination is accomplished by amino acid oxidases which require as coenzyme the presence of flavo-proteins (of which the coenzyme contains riboflavin). The liver is important in deamination. (32)

An alternate pathway of amino acid catabolism is decarboxylation whereby the pharmacologically inert amino acids are transformed into for the most part highly active amines. Decarboxylation itself involves splitting off CO_2 and the enzymes which perform this reaction seem to be highly specific for each amino acid. With the exception of histidine decarboxylase all others require the participation of pyridoxalphosphate as co-enzyme. The kidneys and the liver seem to be responsible for the formation of amines such as tryptamine from tryptophan, of tyramine from tyrosine, and possibly also of histamine from histidine. The presence of large quantities of glutamic acid decarboxylase was discovered in the brain. (33)

Hydroxy-tryptophan is decarboxylated to form hydroxytryptamine (serotonin). Nor-adrenalin seems to be a decarboxylation product of dihydroxy-phenylalanine.

Upon decarboxylation or deamination these compounds lose their character as amino acids. The further metabolic fate of most of the derived compounds is closely linked to that of fats and carbohydrates.

The iodination of tyrosine to monoiodo- and diiodo-tyrosine, and their condensation by the thyroid cells to thyroxine and triiodo-thyronine, is currently the subject of numerous investigations. Thyroxine influences the metabolic activities of essentially all the cells of the body. It excites the mental processes; in hypothyroidism, mentation is slow.(34)

VITAMIN A

Deficiencies of vitamin A occur when few green or yellow vegetables and no liver are included in the diet. The USDA (35) reports in the 1965 survey that 36 per cent of families with income levels under $3000 had diets below the recommended allowances in vitamin A.

Deficiency of vitamin A in growing animals leads to degeneration of cells and fibers in the central nervous system, especially in the cord and medulla. The changes are sufficiently clear and regular to be employed as a biological assay for vitamin A. (36)

Numerous studies have indicated a relationship between vitamin A and the endocrine system. Recently evidence has been presented that a deficiency of vitamin A interferes with production of cortical steroids. Adrenals of vitamin A deficient rats had marked decreased ability to produce these steroids but this could be raised almost to normal by injection of the vitamin (37). Adrenalectomized animals develop hypoglycemia readily on fasting, and are hypersensitive to injected insulin. Corticosteroids enhance gluconeogenesis. Animals deprived of their adrenal glands are particularly sensitive to any kind of stress (38). Corticosteroids especially affect the electrolytes of the extracellular fluids. (39)

Dietary vitamin A has considerable influence upon the rate of thyroxin secretion. Administration of thyroid is associated with increased oxygen consumption. The thyroid hormone also influences glycogen synthesis (40). When the amount of thyroid is depressed, absorption of food stuffs across intestinal mucosa is interfered with. Conversion of carotene to vitamin A is depressed. Hypoglycemia is quite a common finding. (41). In hypothyroidism, mentation is slow (42).

One would expect to find then among people who eat few green and yellow vegetables and little liver, poor response to stress, and decreased physical and mental exertion. Low blood sugar (which increases hypoxic reactions) causes tiredness which can be relieved by eating sugar or crackers, which precipitates more hypoglycemia. The optimum diet would be foods (particularly protein foods) that maintain a steadier blood sugar level and foods that restore deficient nutrients. Eating sugar is reinforcing for tired people with low blood sugar, and this may be part of the reason large quantities of refined carbohydrates are eaten. This leads to further deficiencies, more fatigue, less adequate absorption and utilization of vitamin A, and the cycle descends.

THIAMIN

The richest sources of thiamin are pork, liver, yeast, whole cereals and fresh green vegetables. The poorer sources are rice and non-enriched processed cereals. In Missoula some bakers enrich white bread, others did not. None of the bakers enriched special breads or buns. All flour sold in retail stores was enriched. Therefore some families received adequate amounts of thiamine in enriched bread, others may not.

According to the USDA 1965 food survey (43) 8 percent of the diets did not provide recommended allowances of thiamine. (In their calculations, 44 percent of the grain products were enriched). The allowances were determined for an average amount of carbohydrates. Those eating more carbohydrates would require more thiamin.

A neurasthenic syndrome developed in 4-5 days on less than 150 µg thiamin daily, in some weeks on a diet giving 450 µg. The symptoms of deficiency include lassitude, irritability and anorexia. The BMR is lowered 14 to 33 percent. There is an intolerance to cold. In Wernicke's syndrome there is ophthalmoplegia and peripheral neuropathy, ataxia, clouding consciousness, and high blood pyruvate. Irreversible lesions may occur in cerebral structures. In thiamin deficiency there are failure of memory of recent events, disorientation in time and place, personality changes and lowered performance in memory and dexterity tests. (44)

Anorexia is protective, for forced feeding leads to further development of polyneuritis. Bed rest and fasting are ameliorative in early stages of thiamine deficiency. This is consistent with the theoretical observations that thiamine is necessary for the utilization of carbohydrates, that exercise causes a demand for carbohydrate turnover, and that fat metabolism does not require thiamin (45).

The requirement of thiamine increases with increase in dietary CHO. This reflects the major point of metabolic utilization of thiamine as thiamine pyrophosphate in CHO metabolism; and the considerable dependence of the brain on a specifically CHO metabolism is likely to be a factor which makes symptoms in the CNS so prominent in the deficiency. (46)

The brain compared with other organs of the animal body is moderately rich in thiamine. (47) The level of thiamine derivatives in a given part of the brain, normally varying only moderately, falls markedly in severe thiamine deficiency (48). The fall in cerebral thiamine appears to correspond to the time when signs of disturbance in the nervous system begin. (49)

The lowered cerebral thiamine pyrophosphate of deficient animals is associated with major disturbances in cerebral metabolism. The first of these to be clearly demonstrated was an accumulation of lactic acid in thiamine deficient pigeons, shown to be due to failure to oxidize lactate; for the respiration of separated cerebral tissues of deficient animals, provided _in vitro_ with lactic acid as substrate, was lower than normal. Oxidation of lactate proceeds through pyruvate, and this substance also accumulated in vivo and when added _in vitro_ was oxidized at an abnormally slow rate. As oxidation of pyruvate is the main source of energy for cerebral activities, failure of cerebral function in the deficient animals is understandable. (50)

Several other metabolic sequelae of thiamine deficiency can be attributed to its role in pyruvate oxidation. Thus during in vitro metabolism of cerebral tissues from deficient animals, the formation of acetate, citrate and α ketogluterate is decreased. This and other defects were made good by thiamine pyrophosphate. Acetylocoenzyme A, which is the precursor of each of these substances and also of actylcholine, is an immediate product of the thiamine-catalyzed pyruvate oxidation. This makes understandable the depression in acetylcholine synthesis observed in extracts from the brain of thiamine-deficient rats, a depression made good by added acetylcoenzyme A. (51)

Other cerebral processes involving thiamine phyrophosphate also concern α ketoacids or diketones. About half the cerebral thiamin is brought into play in pyruvate oxidation. As it is involved also in other metabolic processes in the brain, there is clearly little if any excess of thiamine and disturbances of function with moderate depletion is understandable. (52)

The many metabolic and other disturbances of thiamine deficiency make it understandable that hormonal changes should also occur, either through the endocrine organs reacting to these disturbances or becoming themselves deficient in thiamine. Both the Islets of Langerhans and the adrenal medulla hypertrophy in beri-beri; hyperglycemia and reduced glucose tolerance have been found. Combined observation of changes in blood lactate, pyruvate and glucose may give an early indication of mild thiamin deficiency and has been applied to mentally disturbed subjects.

The widespread metabolic changes of the deficiency also make it possible that cerebral functioning is disturbed in part indirectly, for example by high blood pyruvate or methylglyoxal or by changed hormone levels. (53)

One would expect then to find among people who ate small amounts of pork, liver and fresh green vegetables, and large amounts of non-enriched refined carbohydrates (which increase the thiamine requirement) a tendency to sit in front of the TV and not be concerned about getting supper: They feel better with less activity and less eating. This leads to meals that involve no preparation: crackers, cookies, pop and candy. With intellectual function handicapped by inability to metabolize carbohydrates and by deficiencies in acetylcholine, it would be difficult to understand that eating liver and pork is related to behavior. The spiral continues downward.

RIBOFLAVIN

It is not difficult to have a riboflavin-deficient diet if dairy foods and other animal protein sources are omitted. However, according to the USDA 1965 survey (54) only 6 percent of diets were below the recommended allowances.

Mammalian tissues have been shown to have a number of different flavoprotein systems each containing a specific protein (apoenzymes) and a riboflavin-containing prosthetic group (co-enzyme). These enzymes are important components of the oxidative systems in living cells, and it is axiomatic that cellular growth can not evolve in the absence of riboflavin (55).

Neural tissues are not the most sensitive to lack of riboflavins. Changes are commonly first seen in the skin, mouth and eyes but there occurs in man and experimental animals in riboflavin deficiency a lowered physical activity and appetite which may be followed by sudden collapse and coma. Dogs deficient to varying degrees were found lacking in specific tests of performance; the deficiencies led ultimately to demyelination especially in peripheral nerves and in the posterior columns of the spinal cord. (56)

NIACIN

The best sources of niacin are liver, lean meat, poultry, yeast, fish, peanuts and beef heart. Flour is enriched with niacin to bring it up to the level of whole wheat, but whole wheat is not the best source of niacin. The USDA food survey did not include estimates of niacin. 60 mg of tryptophan can be converted to form 1 mg of niacin. Thus niacin must be reported in terms of equivalents, both niacin and tryptophan. A diet of 60 gms of mixed protein would provide 10 mg niacin-equivalents. Pyridoxine, functioning as a coenzyme, is necessary for the conversion of tryptophane to niacin. (57)

Niacin functions in metabolism chiefly as a component of two coenzymes, coenzyme I (cozymase or diphosphopyridine nucleotide, DPN) and coenzyme II (triphosphopyridine nucleotide, TPN). DPN and TPN serve as parts of the intracellular respiratory mechanism of all cells. They assist in the stepwise transfer of hydrogen from a product of glycolysis to flavin mononucleotide which in turn with the help of specific enzymes transfers this hydrogen to the cytochromes which in turn transfer the hydrogen to oxygen to form water. (58)

Pellagra has remained an appreciable cause of secondary illness among patients in mental hospitals and in senile conditions. Probably contributing to this are the faulty feeding habits found among such patients and also the greater difficulty of recognizing in them the mental changes which are prominent among the signs of pellagra. Instances are reported of subjects with mental symptoms akin to those of pellagra often responding to nicotinic acid though an apparently normal diet is being consumed. Abnormality in tryptophan metabolism has been demonstrated in several such people. (59)

Signs of disturbed cerebral function are among the earliest symptoms of pellagra or of nicotinamide deficiency induced experimentally. The symptoms include depression, sometimes with morbid fears, dizziness and insomia, weakness, lassitude, anorexia and indigestion, irritability and emotional instability. More severe or prolonged deficiency brings with the apprehension hallucinations, disorientation or delirium. At several stages and in many subjects nicotinic acid deficiency has proved difficult to differentiate from other psychoses, and indeed nicotinic acid can be regarded as a therapeutic agent for a disease which in its initial stages is often largely a mental disorder.

If the disturbances described are not terminated by making available nicotinic acid or a surrogate, permanent structural changes take place in the brain. (60)

A diet low in meat and high in non-enriched carbohydrates could be deficient in niacin.

VITAMIN C ASCORBIC ACID

The only significant dietary sources of ascorbic acid are fruits, especially citrus fruits, vegetables and liver. Meats, cereals and dairy products contain such small amounts that they are of little importance as antiscorbutic foods.

Ascorbic acid may be involved in an important hydrogen transfer system and may regulate oxidation-reduction potentials within the cells. Ascorbic acid is important in the oxidation of l-tyrosine and phenylalanine by preventing substrate inhibition of the enzyme para-hydroxphenyl pyruvic acid oxidase. In the absence of this vitamin, para-hydroxy phenylpyruvic acid and para-hydroxy phenyllactic acid are excreted in the urine. These are the products of the incomplete oxidation of the phenolic amino acids. It is essential for the protection of folic acid reductase which converts folic acid to dolinic acid, and it may play a part in the release of free folic acid from the folic acid conjugates found in food. It is involved in hydroxylation reactions such as the conversion of proline to hydroxyproline, and tryptophane to 5-hydroxy tryptophane.

The specific chemical effects of ascorbic acid in cellular metabolism are not yet clearly defined though its general effect is that of a water-soluble antioxidant.

The pathologic effects of ascorbic acid deficiency are most apparent in structures of mesenchymal origin: newly formed fibrous tissue, teeth, growing bones and blood vessels.

The pigmentation of the scorbutic patient might be due to a defect in dihydroxyphenylalanine (dopa) metabolism and the occasional instance of megaloblastic anemia found in the scorbutic subject probably is due to an abnormality in the conversion of folic acid to folinic acid since ascorbic acid protects folic acid reductase.

Mazur has shown that ascorbic acid and adenosine triphosphate (ATP) are important for the reduction and release of iron. (61)

PYRIDOXINE (VITAMIN B_6)

Pyridoxine is widely available in natural foods, and a deficiency is not to be expected among people eating natural diets. However, milling of wheat may reduce this vitamin by 80 - 90%, and cooking frozen vegetables may reduce the content by 25%. (62) A diet low in meat and high in refined carbohydrates may be deficient.

Mangay Chung prepared a week's "poor diet", and analyzed it for pyridoxine. The average pyridoxine supplied by the poor diet was 1 mg daily, the lowest amount was 0.7 mg. (63) The recommended allowance for B_6 will fall between 1.5 and 2 mg a day (64). The Mangay Chung diet provided four servings of fruits and vegetables a day, and, for the whole week, 4 servings of oats, 3 of dried beans, two eggs, 3 servings of meat, 6 of milk, and sweets were limited to sugar six times (on oats, in iced tea and lemonade) and two servings of jelly a week. (Quantities were not listed.) Cornbread was served 9 times. Corn grits have amounts of pyridoxine similar to the lower range of whole wheat. Few Head Start diets provide that much vegetables, oats and legumes.

It is possible that a family eating large amounts of refined carbohydrates and small amounts of meat could have a diet deficient in pyridoxine.

In addition to reports of pyridoxine deficiencies in infants on synthetic diets, McIlwain (65) and Vilter (66) cite 14 reports of groups in whom symptoms were successfully treated with pyridoxine.

Hanson (67) reports that of 56 children with epilepsy given 160-200 mg pyridoxine daily, 5 cases showed significant clinical improvement. Convulsions occur when an infant has an unusually high pyridoxine requirement.

Pyridoxal phosphate functions biochemically as a coenzyme for transaminase, codecarboxylase, deaminase, desulfurase and many other enzyme systems. Transamination is probably mediated through the inter-conversion of pyridoxal phosphate and pyridoxamine phosphate. The co-enzyme is necessary for the conversion of tryptophan to the pyridine coenzymes. This vitamin is necessary also for the formation of serotonin from tryptophane and of α amino butyric acid from glutamic acid. Involvement in carbohydrate metabolism is suggested since certain protein apoenzymes as lactic acid dehydrogenase, aldolase and catalase are not formed in adequate amounts when B_6 is deficient. It is also a part of the phosphorylase enzyme system and in this role is important for the conversion of glycogen to glucose-1-phosphate. There is considerable evidence linking it to the metabolism of polyunsaturated fat but the exact role it plays is in doubt. (68)

An important reaction is the conversion of glutamic acid to GABA (α aminobutyric acid) by a decarboxylation reaction. This reaction requires as a coenzyme pyridoxal phosphate which is synthesized from pyridoxine. Neurological disorders caused by a deficiency in this vitamin may be due to its metabolic role in decarboxylation. (69)

Glutamic acid and GABA change the excitability of neurons. A diet deficient in pyridoxine can cause convulsions which are rapidly antidoted by feeding pyridoxine. The interference with pyridoxal phosphate leads to a deficiency of GABA which leads to increased excitability in the neuron (70). Because of their metabolic relationship, an accumulation of glutamic acid rather than a decrease of GABA level may cause an increased excitability and convulsive waves when decarboxylation of glutamic acid is blocked.

Pyridoxine is the coenzyme for the decarboxylase that converts dopa to dopamine, which is then converted to adrenaline and noradrenaline. These are known mediators of the sympathetics. (71)

The catecholamines (noradrenaline, dopamine and adrenaline) have their chief cerebral occurrence in the lower parts of the brain; the richest areas are akin functionally in being the parts of the brain connected with the activity of the sympathetic nervous system. On stimulation they have among their effects the peripheral release of adrenaline, with consequential glycosuria and increase in blood pressure and heart rate. (72)

Tryptophane hydroxylase yields 5-hydroxytryptophan which readily gives serotonin in the brain itself and in cerebral preparations. Administration of 5-hydroxytryptophan to animals is followed by marked central actions, including catatonia and apparent fear or rage which are accompanied by an increase in the serotonin of the brain. (73)

Chemically or metabolically related to the catecholamines or serotonin are many compounds which have characteristic actions on the central nervous system: reserpine, α mathyl-m-tyrosine, pyrogallol, iproniazid and nialamide, emphetamine, mescaline, harmine, lysergic acid diethylamide, yohimbine, methedrine. (74)

Hypermetabolism may increase the vitamin B_6 requirement as it increased the requirements for other vitamins. (75)

The sedative or tranquilizing effect of reserpine is due to its displacing cerebral serotonin and noradrenaline. Chlorpromazine is an antagonist of serotonin. Amphetamine and methedrine inhibit amine-oxidase (which oxidase destroys serotonin). These compounds cause restlessness and insomnia and oppose the action of depressants. Effects can depend on the personality and mood of the subject to whom the agents are given, but include increased attention, alertness, initiative and feeling of well-being. (76)

Thus alertness, initiative, depression, and personality changes in the direction of schizophrenia have been demonstrated to have physiological bases as well as social-environmental bases. Nutritional deficiencies influence serotonin and catecholamine metabolism. Mental disturbances that are treated with tranquilizers are widespread. We eat large quantities of refined carbohydrates with the perhaps false assurance that enrichment with thiamin, riboflavin, some niacin and iron provides what we need. Possibly for those who eat large quantities of white bread, this enrichment unbalances metabolism for pyridoxine, pantothenic acid, folic acid and B_{12}.

Then one might expect that a diet high in refined carbohydrates and low in meat would be a factor in causing susceptibility to depression and frustration, especially when coupled with environmental stress, and particularly for those who have higher-than-average requirements for pyridoxine.

PANTOTHENIC ACID

Pantothenic acid owes its name to its wide distribution in living organisms, and such distribution makes it understandable that well-defined deficiency is very rare in man though lack of pantothenate may colour the symptoms of other nutritional deficiencies. However, the "poor diet" analyzed by Mangay Chung (77) provided an average of 6 mg daily with a range of 5.2 to 7.2 mg. Williams (78) recommended that 10 mg of pantothenic acid would be a safe level of intake. Then a diet deficient in meat, liver, whole grain cereal and certain vegetables might be deficient in pantothenic acid.

Pantothenic acid protects rats from the deleterious effects of severe stress and together with salt, will maintain adrenalectomized rats in reasonable good health. Ralli has reported very interesting results suggesting that pantothenic acid will improve the ability of well-nourished subjects to withstand stress and has bolstered her findings with biochemical corroborative evidence. (79)

Experimentally induced pantothenic acid deficiency in humans produced fatigue, malaise, headache, sleep distrubances... parasthesias in the extremeties, muscle cramps, impaired coordinations and increased sensitivity to insulin. (80)

The contents of pyridoxine, pantothenic acid, folic acid and B_{12} are not known for all foods. The following table, gathered from data in Wohl (81) is presented to enable a rough estimate of pyridoxine in various food groups. Note that milk, the most nearly ideal food for growth, provides relatively small amounts of these vitamins.

AMOUNTS OF SOME B VITAMINS IN VARIOUS FOODS

	Milk	Meat	Liver	Vegetables	Legumes	Whole Wheat
Pantothenic acid micrograms/gm	3.7	5.4-8.9	70-93	2-13	12-21	
Pyridoxine micrograms/gm	65-73	120-580	710-810	20-300	190-800	270-410
Folic acid mg/100 gm	.0006	.0025-.0142	.2941	.0039-.1425		
B_{12} mμg/gm	1.6-6.6	9-66	310-1200			

Individual fruits and vegetables contain the following amounts (μg pyridoxine per 100 gm edible portion): cauliflower, 20, apples 26, peas (fresh) 50-190, lettuce 71, oranges 80, spinach 83, turnips 100, potatoes 160, bananas 300, and legumes 190-800. Eggs contain 22 μg pyridoxine per 100 gm edible portion.

APPETITE FOR SWEETS

Van Liere and Stickney (82) cite 9 studies of mountain climbing expeditions and troops stationed at high altitudes in which "sweets were the most and meats the least palatable", "the appetite may be capricious at high altitudes but that sweet foods such as chocolate and jams are often relished,""there was an increase in carbohydrate consumption (from 39.8% to 44.1%)", "rather than eat foods which did not appeal to them, some refused to eat anything. On the whole, however, appetite for sweets increased." "There was initially a depression of appetite... It was observed that going without food too long at altitudes over 20,000 feet caused considerable fatigue. This could promptly be relieved by eating sugar."

Summary:

Deficiencies of riboflavin (milk) and of ascorbic acid (citrus fruits) handicap growth, wound healing and resistance to disease sooner than they handicap mental function.

With deficiencies of meat, green vegetables and whole grain cereals, and (large amounts of refined carbohydrates) one would expect to find depending on which nutrient is deficient:

Hypoglycemia
Decreased mental and physical exertion, slow mentation, apathy
Hyperactivity, impulsivity
Irritability, depression
Disorientation, impaired coordination
Sensitivity to stress

With the combination of fatigue and hypoglycemia, it is logical that a person who has difficulty making mental or physical exertion would eat candy, crackers, white bread and pop and Koolade. These would immediately ease the fatigue, thus reinforcing the eating of more sweets. Also, people who deal in concrete rather than abstract or relational terms would have difficulty comprehending the need for green vegetables and meat, particularly when vegetables are disliked and meat is expensive. The typical nutritional recommendation is to eat whole grain or enriched cereals, so that there is very little promotion of whole grain cereals. Whole grain cereals may not be necessary in a typical American diet. However, when over 2/3 of the diet is composed of refined cereals and sugars, there may be deficiencies of pyridoxine, pantothenic acid, folic acid and B_{12} as well as of vitamins A and C.

Another nutritionists'recommendation that is not helpful is that sugar is an energy food. This must particularly mislead people whose tiredness in in part due to malnutrition.

Nutritional handicaps could then influence the mother's responsiveness, the child's ability to perform in school, the father's ability to get and keep a job, and the stability of the family. These are also social and emotional handicaps which in turn influence the ability of the family to purchase food and the ability and motivation of the mother to prepare adequate nutrition. Is this cycle part of the cycle of hopelessness, alienation, frustration with inadequate education, inadequate housing, inadequate medical care, etc. etc.? Such a cycle is outlined on the following page. This study attempts to gain insights as to which of these factors are pertinent to the behavior of Missoula Head Start children.

FACTORS THAT MIGHT OPERATE IN A CYCLE OF MALNUTRITION AND POVERTY

Small Amounts of	Cause Disturbances in	Cause Symptoms
MEATS		
Complete protein	Formation of all tissues, enzymes, hormones	
Iron	Oxygen transport, cytochrome formation	Weakness, listlessness, anemia
Thiamin (pork) .	Oxidation of pyruvates (energy for cerebral function) Acetylcoenzyme A (precursor of acetylcholine)	Lassitude, disorientation of time and place
Niacin	Formation of nicotinamide anenine dinucleotides (NAD)	Depression, morbid fears, emotional instability
Pyridoxine . . .	Formation of serotonin (depressions arise from deficiencies & psychotic excitement from excess; inhibits excitatory action of excitatory presynaptic terminals) and formation of GABA and of dopamine.	Anemia, depression, psychotic excitement
Pantothenic acid	Formation of acetylcholine (principle mediator for the parasympathetics)	Disturbances of the nervous system, anemia
B_{12}.	Transmethylation, methyl biosynthesis, and purine-pyrimidine nucleoside biosynthesis	Pernicious anemia, indisposition to bodily or mental exertion
GREEN VEGETABLES		
Vitamin A. . . .	Production of cortical steroids and thyroid; affects catecholamines which act on sympathetic effectors: fight or flight.	Hypoglycemia and sensitivity to stress, slow mentation, irritability.
Folic acid . . .	Transfer of single carbon units, formation porphyrn ring	Anemia
CITRUS FRUIT		
Vitamin C. . . .	Oxidation of tyrosine, release of cortico steroids	Anemia
MILK		
Riboflavin . . .	Formation of flavoprotein enzymes (in oxidative systems)	
Calcium.	Decrease in extracellular Ca^{++} at myoneural junction inhibits transmission; this is overbalanced by excitatory effect of low Ca^{++} level on nerve and muscle cells.	Disturbances in nerve function
Complete protein		
WHOLE GRAIN CEREALS		
Iron & B vitamins		
Large Amounts of		
REFINED CEREALS		
Deficient in pyridoxine, B_{12}, Pantothenic acid, folic acid		

Unstable family relationships
Poor educational performance
Marginal employment; low income
Preference for quick-energy foods

PART III

A DESCRIPTION OF HEAD START FAMILIES WITH EMPHASIS ON ASPECTS OF A MALNUTRITION-POVERTY CYCLE

PURPOSE:

1. To describe the home diets, heights, weights, attendance and socio-economic data of 113 Head Start children and their families.

2. To present possible associations among performance on intelligence tests, teachers ratings and hemoglobin levels with home diets.

A. Are small amounts of green vegetables (vitamin A) associated with slow mentation and effects of hypoglycemia?

B. Are deficiencies in B vitamins associated with handicapped nerve function: attention span, distractibility, hyperactivity, coordination, perservation, and ability to understand directions and IQ?

C. Are vitamin C (citrus fruit) deficiencies related to sensitivity to stress and hypoglycemia? (There was no specific rating for that). One would not expect vitamin C to be related to activity or nerve function, unless hypoglycemia might be, but since children were fed snacks on arrival in class and lunch at the end, hypoglycemia would be of short duration

D. Are riboflavin and calcium (milk) deficiencies related to any behavior? One would not expect them to be related to nerve function .

E. Are deficiencies of iron related to irritability, apathy and activity levels?

PROCEDURE:

In September, 1967, before classes began, mothers of 115 Head Start children were interviewed about home diets. They were asked what foods they thought should be served at Head Start, about diet during their pregnancy and their children's infancy, for 24-hour recall and for the amounts of various food groups their children ate in a typical week. The questionnaire is in the appendix.

Data about the age and sex of family members, the 1966 and present income (which had been verified by looking at W2 forms) and parent education were taken from the Head Start intake records. The number of children included the total children in the family, the number of children living away from home was learned in interviews. Data about birth weight was taken from the physical examination records. Other socio-economic information was gathered in personal interviews by a psychology student (husband of the social worker who checked data) and a Head Start mother. Some family situations were complex and required as many as four interviews.

Income as percent of guidelines was the income divided by the poverty guideline for the size family living at home times 100.

Questions about amounts of debt and education of grandparents were difficult to answer. When they were re-worded so the answer required checking one of four ranges, they were more easily answered. Questions about changes in income, occupation, and house and community moves pertained to the last five years, the child's lifetime. Questions about welfare status pertained to the married life of the mother. The welfare information was for all families who had at some time received welfare as well as those currently receiving it.

The number of community organizations included memberships by all members of the family. Participations included PTA meetings but not school functions.

The number of subsequent marriages included only formal re-marriages.

Occupation status was rated by the North Hatt (NORC) Scale with interpolations by Jonassen etal and reported by Wilson and Kolb (83).

Students were rated as 5 points below the occupation for which they were preparing (a student rank would not have differentiated between training to be a welder or to be a teacher). Fathers in jail (3) were rated as no father in the home. Professional gamblers (2 grandfathers) were not rated. Grandparent's occupation was that prior to retirement.

For 24-hour recall, simulated servings of clay were made and baked in 1/2 cup, 1/4 cup, two tablespoons and 1 tablespoon amounts. Mothers could pick out approximate serving size without having the models suggest specific foods. The clay-colored mounds could represent macaroni, peas, etc. Flat models, 3" x 2" x 1/2" represented 1 oz of meat or cheese. A model half that size represented 1/2 ounce. All of these were available for each mother to put on an 8" plate to estimate portion sizes.

Amounts of nutrients reported in 24-hour recall were calculated according to food values reported in Bowes and Church (84).

Combination dishes were calculated as 1/4 meat. Therefore amounts of meat are probably calculated as higher than actually served. All breads, macaroni, noodles and spaghetti were calculated as enriched. Cakes, cookies, etc. were calculated as reported in Bowes and Church, though some undoubtedly contained no eggs or milk, (like Poverty Cake).

Calculations would have been easier if the models for portion-sizes had been the same as those described in Bowes and Church (2/5 cup instead of 1/2 cup).

Diets reported as typical amounts eaten by the child per week were totaled as half cups (green and yellow vegetables, citrus fruits and legumes), cups (milk, other fruits and vegetables), ounces (meats, enriched cereals and non-enriched carbohydrates). These roughly approximated food exchanges, so amounts of cereals and other refined carbohydrates could be calculated as percentage of total number of food exchanges. 1/2 cup macaroni contains 22 gms carbohydrate, and hence was roughly equivalent to 1 oz candy which contains 24 gms carbohydrate. Oz of meat, eggs and half cups of legumes could be totaled since each contains about 7 grams protein. Ice cream and cocoa were recorded as both milk and refined carbohydrate (sugar). Cheese was converted to milk: 1 oz yellow cheese or 1 cup cottage cheese was equivalent to 3/4 cup of milk.

Amounts of food groups were calculated also as percentages of the Low Cost Food Plan, with some modifications. Our green vegetables included peas, lettuce, green beans and cabbage. The LCFP dark green or deep yellow vegetables did not include these. Therefore those amounts were transferred from the LCFP vegetables to our green vegetable group. Tomatoes were also transferred to our green vegetable group. Non-enriched carbohydrates (crackers, cookies, sweet rolls and rice) were added to LCFP sugars to form the non-enriched carbohydrates group. Amounts were converted from pounds to serving portions using amounts reported in the Head Start Food Buying Guide; (85) for example, 9 pounds of oranges makes 25 1/2 cup servings.

Amounts of food used as the LCFP standard as modified are given Table IX.

TABLE IX

AMOUNTS OF FOOD GROUPS IN MODIFIED LOW COST FOOD PLAN AND PERCENTAGES OF THEM

	Enriched Cereals half cups or oz.	Milk cups	Eggs	Meat oz.	Legumes Half Cups	Citrus Fruits Half Cups	Green-Yellow Vegets Half Cups	Other Vegets cups	Non-Enriched Cereals Half cup or oz.	Fats Table-spoons
133 % LCFP	40								18	
100 % LCFP	30	16	5	22	2.2 (2)	3	8	8	14	14
66 % LCFP	20	11	3	15	1.5 (2)	2	6	5	10	
50 % LCFP	14	8	2	11	1.1	1	4	3	6	

The amount reported spent for food each week divided by the total cost of the LCFP in September, 1967 (reported in a Family Economics Review, Dec. 1967) for the age and sex of each family's members was calculated to give percentage of the cost of the LCFP that was spent for food.

Twelve graduate students (doctoral candidates in psychology) who had had courses in giving individual intelligence tests gave to all children in October and May, and to half the children in February, individual Wechsler and Primary Scale of Intelligence to the five year olds and Wechsler Intelligence Scale for Children to the six year olds.

Teachers gave Lorge Thorndike Intelligence Tests (Forms A and B) to all children in groups of 5 to 8, in October and May. This was a measure of the children's ability to perform in groups.

Teachers rated each child on a scale from 1-7 in classroom and playground activity, general and fine motor coordination, quickness of reaction to authority, ability to understand directions, attention span, independence in the classroom and on the playground, perseveration, distractibility, self-expression and hyperactivity. All children were rated in October and May, half in February. Hemoglobin levels were determined for all children in October and May, and for half the children in February.

3 x 4 and 4 x 6 tables were made grouping all data in hemoglobin levels below and above 12.5 (the national average for 5 year olds), in IQ ranges 75 and below, 76-89, 90-110, 111-124 and above, and in teacher rating ranges 1-2, 3-5, and 6-7.

70 items were tabulated with these 16 factors, 1120 tables. To determine which relations should be studied in detail, the differences between sums of opposite corners were determined. The total number of children in the upper left and lower right corners roughly indicated a positive correlation. The total number in the lower left and upper right corners roughly indicated a positive correlation. The total number in the lower

left and upper right corners roughly indicated an inverse. The differences between these totals would indicate a preponderance of either positive or inverse relationships, or no differences. Those children in IQ ranges 90-110 and in teacher rating ranges 3-5 were considered average and not included in these totals.

Eggs, legumes and meats were combined into a meat group, green-yellow vegetables, citrus fruits and other fruits and vegetables were combined into a fruit-vegetable group. Enriched cereals and non-enriched cereals were combined into a refined carbohydrate group. The average WPPSI scores for those children whose diets provided the largest and smallest amounts of these combinations of food groups were calculated.

RESULTS:

Food

Since milk (the primary food source of vitamin D when fortified) provides 400 IU per quart, a child who drinks the recommended amounts of milk (2 1/2 cups a day) would still not get the recommended amount of vitamin D. Only one child was reported in 24-hour recall to drink the quart of milk a day required to get 400 IU vitamin D. I did not know how to calculate sunshine sources. Vitamin D deficiencies are reported to affect growth more than behavior. Hence vitamin D amounts are excluded from the following calculations.

Four diets of the 113 final sample reported in 24-hour recall provided the recommended allowances for 5 year olds of calories, protein, calcium, iron,thiamin, niacin, ascorbic acid, and vitamin A. Eighty percent provided less than 2/3 the recommended allowances in at least 1 nutrient.

Three diets provided suggested amounts of the combined meat-egg-legume group, fruit-vegetable group, enriched cereal and milk. 75 % of the diets provided less than 2/3 of the suggested amounts of food groups, (modified Low Cost Food Plan).

Nationally, according to the USDA 1965 national survey of American diets (86) good diets, those meeting allowances for all seven nutrients, were found in 5 out of ten households. Nationally, one-fifth of the diets rated poor (below 2/3 of the recommended allowances); for households with incomes under $3000 (regardless of the size of the household) 36 % of the diets were poor.

Iron was below allowances for 89 % of Head Start Children (compared to the national 10 % below allowances). The national figure referred to households, our figure refers to children, whose requirement for iron is proportionaly higher.

73 % of Head Start diets were below allowances in vitamin C, compared to the national 27 %. 51 % of Head Start diets were below allowances in vitamin A, compared to the national 26 %.

This pattern of deficiencies is reflected in the amounts of food groups eaten: 85 % were below the suggested LCFP amounts of meat and legumes. 93 % of Head Start diets were below suggested amounts of green and yellow vegetables, and 78 % were below in citrus fruits.

69 % ate more than the recommended amounts of enriched cereals, and 93 % ate more non-enriched carbohydrates. The amounts of enriched cereals and amounts of non-enriched refined carbohydrates each represented half the recommended calories for

about a fourth of the children.

Amounts of milk reported averaged one cup per day when reported as 24-hour recall, and three cups a day when reported as amounts typically consumed in a week.

For 19 children refined carbohydrates (both enriched and non-enriched) constituted 50 % or less of the total number of food exchanges. For 21 children, refined carbohydrates constituted 66 % or over of the total food exchanges. For 56 children, refined carbohydrates constituted between 51-65 % of the diet.

4 %, 4 % and 7 % of the diets were below 2/3 of the allowances in protein, thiamin and riboflavin.

The data about amounts of food groups and nutrients are tabulated in Tables X and XI.

The average family spent 85 % of the cost of the low cost food plan for food. For the 38 % spending less than 75 % of the LCFP, unless one had unusual nutritional knowledge, it would be difficult to provide optimum nutrition in the American style of eating.

One mother reported spending $10 a week to feed her family of 8; the cost of the LCFP for her family was $41. She said, "First I buy my basics: flour, lard and potatoes. If I have any money left, I buy some vegetables or chicken." She reported potatoes served 6 times a week, a half cup of other vegetable, 1 piece of chicken and 1 2-ounce serving of beef a week. She reported 3 cups of milk a day; (I have never seen milk on her table.) Their income was 25 % of the poverty level.

Some fathers were hunters and fishermen; their families had

TABLE X

% OF CHILDREN EATING VARIOUS AMOUNTS OF FOODS ... Amounts of food groups are divided according to percents of Low Cost Food Plan which suggests weekly quantities of food groups for 5-year-olds

	50 % LCFP and less	51 - 65 % of LCFP	66 - 99 % of LCFP	100 - 133 % of LCFP	134 % & more of LCFP	n
Enriched Cereals	10-14 oz 5 %	16-20 oz 6 %	22-28 oz 20 %	30-40 oz 37 %	42-78 oz 32 %	99
Milk	6-8 cups 12 %	9-11 cups 4 %	12-15 cups 9 %	16-50 cups 75 %		99
Eggs (number)	0-2 31 %	3 18 %	4 15 %	5-14 36 %		99
Meat (oz)	2-11 oz 53 %	12-15 oz 22 %	16-21 oz 10 %	22-62 oz 15 %		99
Legumes (half cups)	0-1 54 %	2 24 %	3 9 %	4-9 13 %		99
Citrus Fruits (half cups)	0-1 45 %	2 14 %	3 19 %	4-16 2 %		99
Green & Yellow Vegetables (half cups)	0-4 76 %	5-6 7 %	7 10 %	8-22 7 %		99
Other Vegetables (cups)	0-3 22 %	4-5 25 %	6-7 28 %	8-36 25 %		99

	100 % LCFP & below	101-133 % LCFP	134-200 % LCFP	201-300 % LCFP	301-500 % LCFP	501% & over
Non-enriched carbohydrates	4-14 oz 7 %	16-18 oz 10 %	20-28 oz 30 %	30-42 oz 28 %	43-70 oz 21 %	72-136 oz 4 %
Fats (Tbs)	2-14 T 74 %	15-19 T 12 %	20-70 T 14 %			

TABLE XI

% OF CHILDREN GETTING VARIOUS AMOUNTS OF NUTRIENTS IN HOME DIETS. Amounts of nutrients are divided according to percentages of Recommended Daily Allowances

	49 % recom allow & below	50-65 % recom allow	66-99 % recom allow	100 % recom allow & over	
Calories	451-899	900-119	1200-1799	1800-3699	
	3 %	20 %	49 %	28 %	n=96
Protein (gms)	18-21	22-28	29-43	44-160	
	1 %	3 %	11 %	85 %	n=96
Calcium (mg)	89-399	400-532	533-799	800-2151	
	13 %	4 %	22 %	61 %	n=96
Iron (mg)	2-4	5-7	8-10	11-18	
	6 %	36 %	38 %	20 %	n=96
Thiamin (mcg)	349	350-466	467-699	700 -2338	
	0 %	4 %	24 %	72 %	n=96
Riboflavin (mcg)	365-549	550-733	734-1099	1100-6346	
	5 %	2 %	7 %	86 %	n=96
Niacin (mg)	4-5	6-7	8-11	12-28	
	5 %	16 %	41 %	38 %	n=96
Ascorbic Acid (mg)	0-26	27-35	36-53	54-252	
	49 %	16 %	7 %	28 %	n=96
Vitamin A (IU)	443-1399	1400-1875	1876-2799	2800-66206	
	9 %	13 %	29 %	49 %	n=96
Vitamin D (IU)	0-199	200-265	266-399	400-475	
	52 %	23 %	24 %	1 %	n=96

Carbohydrates (gms)	No Recommended Allowances				
	66-149	150-199	200-249	250-299	300-465
	28 %	31 %	22 %	10 %	9 %
					n=96

more meat. Some families had gardens; they had more vegetables. Some children disliked vegetables or disliked meat. There was not a single food pattern for the whole group.

Of the 22 whose diets provided suggested amounts of either fruit-vegetables or meat groups, 3 contained suggested amounts of all three groups (meat, vegetable-fruit and milk); 11 were below suggested amounts in meat, 6 in vegetables, and 3 in milk.

Data about amounts spent for food are presented in Table XII.

The median income level was 80 % of the poverty level. Data about incomes are reported in Tables XIII through XVI.

The median height was 98 % of the national 50th (median) centile as reported by Falkner (87); median weight was 100 % of the 50th (median) centile. 8 % were under the 5th centile and 1 % over the 95th centile in height; 2 % were under the 5th centile and 11 % over the 95th centile in weight. The median child gained 86 % of the standard gain in height and 104 % of the standard gain in weight between October and May. Data on height and weight are presented in Tables XVII , XVIII and XIX.

The median family size was 6. Since the median income was $3200, the median family lacked $1000 a year of having enough money to buy necessities by the national standard. Since Missoula's cold climate demands heating a house and furnishing snow suits, eating more but having a shorter growing season than the national average, the lack of $1000 is a crippling handicap.

Data about sibling rank and numbers and sex of children are presented in Tables XX , XXI and XXII.

5 % of mothers reported changing diets positively during

TABLE XII

% OF FAMILIES SPENDING VARIOUS AMOUNTS FOR FOOD (Recorded as % of Low Cost Food Plan for Each Family)
n = 95

50% LCFP and Under	10%
51 - 75% LCFP	28%
76 - 100% LCFP	33%
101 - 125% LCFP	15%
126% LCFP and above	14%

TABLE XIII

% OF FAMILIES IN VARIOUS INCOME CATEGORIES

Income	1966, n = 104	1967, n = 104
$920 - $1999	14%	6%
$2000 - $2999	26%	37%
$3000 - $3999	23%	32%
$4000 - $4999	21%	16%
$5000 - $5999	9%	7%
$6000 - $19,020	7%	2%

TABLE XIV

Amount Income Changed per Month in Past Five Years	n = 88
Decreases	
$251 - 500	10%
$250 - $151	16%
$150 - $51	16%
minus $50 - plus $50	39%
Increases	
$51 - $150	15%
$150 - $250	4%

TABLE XV

1967 Income as Percent of Poverty Guidelines for Family Size n = 105

25% - 55% of Guidelines	8%
56% - 70%	25%
71% - 85%	29%
86% - 100%	23%
101% - 161%	16%

TABLE XVI

Trends in Income Changes Over Past Five Years n = 96

No Change	18%
Decrease Over 5 Years	38%
Decrease, Then Increase	15%
Increase, Then Decrease	10%
Increase Over 5 Years	11%

TABLE XVII

% OF CHILDREN IN VARIOUS WEIGHT AND HEIGHT CATEGORIES

October Ht and Wt as % of Standard for Age and Sex

	77-80%	81-90%	91-95%	96-100%	101-105%	106-115%	116%-142%
Height n = 97	0%	2%	26%	50%	18%	4%	0%
Weight n = 98	3%	19%	14%	20%	16%	17%	11%

TABLE XVIII

Height Change as a % of Standard Gain for Age and Sex

	0-60%	61-80%	81-100%	101-120%	121-140%	141-200%
Oct-Feb n = 52	15%	21%	31%	6%	15%	12%
Oct-May n = 82	15%	18%	34%	22%	6%	5%
Feb-May n = 46	33%	0%	26%	24%	0%	17%

TABLE XIX

Weight Change as a % of Standard Gain for Age and Sex

	-44-1% Lost Wt.	0-50%	51-75%	76-100%	101-125%	126-150%	151-479%
Oct-Feb n = 53	11%	13%	17%	6%	15%	15%	23%
Oct-May n = 83	1%	12%	12%	22%	22%	14%	17%
Feb-May n = 48	11%	29%	11%	6%	6%	6%	31%

TABLE XX

% OF CHILDREN IN VARIOUS SIBLING RANKS n = 105

Birth Order	
1st	13%
2nd	27%
3rd	20%
4th	13%
5th	10%
6th	4%
7th	1%
8th	4%
9th	4%
10th	2%
11th	1%
12th	1%

TABLE XXI

% OF FAMILIES WITH VARIOUS NUMBERS OF CHILDREN n = 105

No. of Children	
1	2%
2	13%
3	21%
4	21%
5	10%
6	14%
7	4%
8	2%
9	6%
10	3%
13	4%

TABLE XXII

% OF CHILDREN OF EACH SEX n = 113

Males	56%
Females	44%

TABLE XXIII

% OF MOTHERS REPORTING VARIOUS DIET CHANGES IN PREGNANCY n = 94

No Change	76%
Some Change	10%
Definite Positive Change	5%
Negative Change	9%

pregnancy, such as drinking extra milk or taking vitamins. Data about diets during pregnancy and infancy are given in Tables XXIII, XXIV and XXV.

The average fall WPPSI was 94.8 (median 96); the average spring WPPSI was 102.4 (median 102). The average gain was 7.6 points WPPSI. There was no statistically significant difference in changes in IQ between those who began with low IQs and those who began with high IQs. Data on IQs are given in Tables XXVI, XXVII, and XXVIII.

About a third of the five year olds were not recommended for promotion to first grade, but for a second year in Head Start. That recommendation was not pertinent to six year olds. These recommendations are presented in Table XXIX.

Teacher ratings are presented in Table XXX.

Welfare

In September, 1967, 17 Head Start families were receiving welfare assistance.

Information about welfare histories are presented in Table XXXI, about debts in Table XXXII, and about occupations in Tables XXXIII and XXXIV.

Of the 113 Head Start families in this study, 98 answered the questions about welfare history. Of these, 57 had received assistance from welfare at some time in their married life. 28 of these families had received over $100 as their last payment. The median duration of assistance received for the total Head Start population was 2 months. The average was 10.5 months.

The average duration of assistance for only those families

TABLE XXIV

% OF MOTHERS REPORTING VITAMIN SUPPLEMENTS GIVEN AT HOME n = 97

None	46%
Part-time	28%
Regularly	26%

TABLE XXV

% OF MOTHERS REPORTING VARIOUS INFANT FEEDING PRACTICES

Bottle or Breast Fed	n = 98
Bottle Fed	74%
Combination	8%
Breast Fed	18%
Foods Fed at 6 Months	**n = 95**
Table Foods	12%
Table Foods and Baby Foods	14%
Cereal Only	3%
Baby Foods	71%
Meat Supplements Fed at 6 Months	**n = 95**
No Meat	50%
Vegetables with Meat	14%
Meat or Egg	33%
Both Meat and Egg	3%
Diet at 12 Months	**n = 97**
Table Foods	83%
Table and Baby Foods	15%
Baby Foods	2%

TABLE XXV (continued)

Age Weaned n = 98		Age Koolade and Pop Given n = 98
0 - 5 mos.	27%	27%
6 mos. and over	7%	3%
9 mos.	20%	5%
12 mos.	30%	33%
15 mos.	10%	9%
18 mos.	10%	12%
21 mos.	3%	0%
24 mos.	13%	33%
27 mos.	5%	3%

Feeding Problems n = 97

None...87% Slight...1% Definite...7% Severe...5%

TABLE XXVI

% OF CHILDREN WITH VARIOUS INTELLIGENCE TEST SCORES

Lorge Thorndike Scores

	57-75	76-89	90-110	111-124	125-139
October n = 98	11%	32%	50%	6%	1%
May n = 89	8%	17%	59%	13%	3%

WPPSI and WISC Full Scale Scores

	57-75	76-89	90-110	111-124	125-139
October n = 103	6%	28%	55%	10%	1%
February n = 43	7%	26%	44%	23%	0%
May n = 81	6%	10%	58%	17%	9%

TABLE XXVI (continued)

WPPSI and WISC Verbal Scores

	57-75	76-89	90-110	111-124	125-139
October n = 103	9%	26%	48%	17%	0%
February n = 43	12%	18%	54%	14%	2%
May n = 81	5%	9%	63%	13%	10%

WPPSI and WISC Performance Scores

	57-75	76-89	90-110	111-124	125-139
October n = 103	4%	33%	47%	15%	1%
February n = 43	2%	19%	63%	14%	2%
May n = 81	4%	19%	49%	22%	6%

TABLE XXVII

WPPSI VERBAL SUBSCORES

	1-6 & below	7-8	9-11	12-19	n
Information					
Oct	21%	17%	44%	18%	103
Feb	14%	28%	30%	28%	43
May	14%	22%	36%	28%	81
Vocabulary					
Oct	27%	22%	23%	28%	103
Feb	33%	16%	30%	21%	43
May	15%	18%	31%	36%	81
Arithmetic					
Oct	19%	18%	44%	19%	103
Feb	19%	14%	42%	25%	43
May	6%	27%	42%	25%	81
Similarities					
Oct	17%	20%	34%	29%	103
Feb	14%	12%	46%	28%	43
May	12%	4%	35%	49%	81
Comprehension					
Oct	19%	20%	41%	20%	103
Feb	16%	21%	32%	30%	43
May	8%	17%	29%	46%	80

2

TABLE XXVIII

WPPSI AND WISC PERFORMANCE SUBSCORES

	1-6	7-8	9-11	12-19	n
Animal House					
Oct	21%	30%	41%	8%	84
Feb	6%	41%	35%	18%	33
May	13%	27%	38%	22%	63
Picture Completeness					
Oct	14%	19%	42%	25%	103
Feb	7%	14%	40%	39%	43
May	6%	10%	34%	49%	81
Mazes					
Oct	7%	19%	47%	27%	84
Feb	0%	9%	46%	45%	33
May	3%	11%	43%	43%	63
Geometric Design					
Oct	16%	31%	32%	21%	84
Feb	12%	27%	43%	18%	33
May	14%	18%	30%	38%	63
Block Design					
Oct	9%	30%	44%	17%	103
Feb	7%	25%	40%	28%	43
May	6%	18%	44%	32%	81
Picture Arrangement					
Oct	21%	42%	32%	5%	19
Feb	10%	20%	70%	0%	10
May	6%	28%	44%	22%	18
Object Assembly					
Oct	11%	31%	47%	11%	19
Feb	30%	0%	30%	40%	10
May	33%	6%	22%	39%	18
Coding					
Oct	21%	37%	26%	16%	19
Feb	20%	20%	50%	10%	10
May	33%	34%	22%	11%	18

TABLE XXIX

% OF CHILDREN RECOMMENDED FOR PROMOTION TO FIRST GRADE OR NOT n = 94

No	29%
Yes	53%
7 year olds	18%

TABLE XXX

% OF CHILDREN WITH LOW, MEDIUM AND HIGH TEACHERS' RATINGS

	1 - 2 (Low)			3 - 5 (Med)			6 - 7 (High)			n		
	F	W	S	F	W	S	F	W	S	F	W	S
Activity Level Classroom	6%	5%	5%	75%	78%	67%	19%	17%	28%	107	60	93
Activity Level Playground	5%	2%	2%	79%	85%	70%	16%	13%	28%	107	60	93
General Motor Coordination	14%	13%	7%	74%	77%	74%	12%	10%	19%	107	60	93
Fine Motor Coordination	16%	15%	13%	75%	78%	69%	9%	7%	18%	107	60	93
Reaction to Authority	26%	23%	17%	52%	63%	67%	22%	13%	16%	107	60	93
Ability to Understand Directions	13%	12%	6%	68%	74%	70%	19%	14%	24%	106	59	93
Attention Span	20%	19%	16%	65%	73%	71%	15%	8%	13%	106	59	93
Independence in Classroom	13%	14%	5%	67%	76%	73%	20%	10%	22%	106	59	93
Independence on Playground	11%	5%	3%	69%	85%	75%	20%	10%	22%	106	59	93
Perseveration	7%	10%	4%	70%	68%	74%	23%	22%	22%	106	59	92
Distractibility	18%	19%	16%	66%	74%	73%	16%	7%	11%	107	59	93
Self-Expression	20%	17%	12%	57%	61%	65%	23%	22%	23%	107	59	93
Hyperactivity	14%	15%	18%	63%	71%	66%	23%	14%	16%	107	59	93

TABLE XXXI

% OF FAMILIES IN VARIOUS WELFARE CATEGORIES

Total No. of Months Have Been on Welfare	n = 97
0	42%
1 - 6	20%
7 - 12	9%
13 - 24	17%
25 - 120	12%
Number of Times Welfare Received	**n = 97**
0	42%
1	31%
2	20%
3	2%
4	2%
5	1%
8	2%
Last Type of Welfare Received	**n = 96**
0	43%
Full ADC	27%
Part ADC	6%
Gen'l. Assistance and Emergency Aid	
1 time	17%
2 times	0%
3 times	6%
Medical Aid	1%

TABLE XXXI (continued)

Last Amount of Welfare Received/Month	n = 85
0	48%
$1 - $50	7%
$51 - $100	12%
$101 - $200	14%
$201 - $332	19%

Causes of Welfare Last Received	n = 98
None	42%
No Father	34%
Disability	11%
Unemployment (Seasonal or own business)	9%
Unemployment (Other and Chronic)	4%

TABLE XXXII

% OF FAMILIES REPORTING VARIOUS AMOUNTS OF DEBTS

	Consumer n = 95	Solid (Investment) n = 95	Medical n = 94	Auto n = 95
None	43%	66%	22%	55%
$1 - $100	10%	1%	18%	6%
$101 - $500	27%	1%	33%	18%
$501 - $1000	10%	0%	13%	7%
$1001 and over	6%	32%	14%	14%

TABLE XXXIII

% OF FAMILIES REPORTING VARIOUS OCCUPATIONAL STATI

	No Husband (wife)	Pre-Voc Training	Unemployed ¢ Employable	Homemaker (or Disabled Man)	NORC Ratings		
					33-48	49-62	63-79
Husband n = 105	45%	3%	1%	5%	23%	11%	12%
Wife n = 106	2%	5%	0%	63%	11%	9%	10%
Grandparents							
Mat.G.M. n = 88	0%	0%	0%	70%	16%	8%	6%
Mat.G.F. n = 86	0%	0%	0%	0%	21%	33%	46%
Pat.G.M. n = 87	0%	0%	0%	67%	11%	14%	8%
Pat.G.F. n = 82	0%	0%	0%	0%	24%	24%	52%

TABLE XXXIV

% OF FAMILIES REPORTING VARIOUS TRENDS IN JOBS IN PAST FIVE YEARS n = 97

Trends in Status of Job of Head of Household	
No Change	45%
Decrease over 5 Years	28%
Decrease, Then Increase	10%
Increase, Then Decrease	4%
Increase over 5 Years	13%

TABLE XXXV

% OF CHILDREN WITH VARIOUS RANGES OF PULSE RATE n = 84

79 and below	13%
80 - 84	18%
85 - 90	29%
91 - 95	10%
96 - 100	18%
101 and over	12%

having received aid was 18.9 months. One parent families received 15.2 months aid; 2-parent families averaged 16.0 months aid. (1 parent n = 26; 2 parent, n = 27).

The mean number of children for all families who had received welfare was 5.1; for families who had not received aid, 4.7.

The amount of debt owed by families who had received welfare averaged \$193; those who had not received public aid averaged \$303; for all Head Start families debt averaged \$241. Of those families who had received welfare, medical bills were \$100 greater than the average of consumer and car debts. Of the non-welfare families, medical debt was \$35 greater. This is an interesting difference since welfare pays for medical care during assistance. The majority of children of those families who had received welfare had above-average hemoglobin levels; the majority of non-welfare families did not. (The difference was 6 children.) Welfare and non-welfare families each had 16 children with IQs below 90, welfare families had 4 more children with IQs over 111.

Unemployment

Of the 61 families with fathers in the home in September, one employable father was unemployed and had been chronically unemployed in the three years we have known him (he is now participating in Vocational Rehabilitation). Five fathers were disabled.

Of families with fathers in the home, 17 had received welfare aid during the time the father was there. Of these 17, 12 had job status scores below 54, 5 above, and 3 of these 5 were students. (54 are milk route men, restaurant cook and truckdriver;) (above 54, clerk in store, barber, machine operator, factory).

Unemployment in Missoula increased during the winter when logging and building industries lay men off.

One-Parent Families

Forty-two Head Start families in September had only one parent living in the home. Four of the missing parents were deceased and 38 divorced or separated. Of these 42 families, with one exception, the mother was the remaining parent. 26 of these had received at some time welfare aid, 10 had received no public assistance, and for 6 this information was not available. The total group of solo parents received a mean of 15.2 months assistance.

The average amount of debt for the 42 solo parents was $464 compared to $722 debt for the total Head Start population (these debts include investments such as for a carpenter's tools).

Solo parents averaged 4.2 children, compared with an average of 5.2 children in 2-parent families. Numbers of children in various types of families are given in Table XXXVI.

TABLE XXXVI

AVERAGE NUMBER OF CHILDREN IN VARIOUS TYPES OF FAMILIES

	1-parent families average number of children	n	2-parent families average number of children	n
Welfare families	4.9	26	5.2	28
Non-welfare families	3.4	10	5.3	20
Combined welfare and Non-welfare families	4.2	42	5.2	48

The average family size (including parents) was 6.3.

Families with Stepfathers

Of 113 Head Start Children, 7 had stepfathers in the home. This includes only formal remarriages and not some relatively permanent parental images, regardless of their value.

Vocational Education

Of the 113 heads of household, 14 were receiving vocational training in September. Of these, 8 were Indian families brought in to Missoula for a pre-vocational program for developing academic abilities in preparation for vocational training. Five were students at the University of Montana (3 majors in education, one in forestry and one in social welfare). One father was receiving job training as a welder. Five of these parents were mothers, 8 were fathers.

Data about pulse rates are presented in Table XXXV , about attendance in Table XXXVII. The median attendance in the first two months was 94 %, in the winter and spring it fell to 85 % and 87 %.

The data about education are presented in Table XXXVIII. The majority of parents had not finished high school; 15 % of mothers and 10 %of fathers had attended college.

Data about ethnic groups are presented in Table XXXIX. Other than the eight Indians brought to Missoula for prevocational training, 4 % of the families were Mexican or Indian. Of these, two could be identified by appearance.

5 % of the mothers had been below age 17 at conception, 6 % had been over 38 years. There were 10 % more children below

TABLE XXXVII

% OF CHILDREN WITH VARIOUS RANGES OF ATTENDANCE IN HEAD START CLASSES

	31-69%	70-79%	80-89%	90-100%
Fall, n = 96	7%	10%	17%	66%
Winter, n = 93	17%	10%	32%	41%
Spring, n = 90	12%	21%	23%	44%

TABLE XXXVIII

% OF FAMILIES REPORTING VARIOUS EDUCATION LEVELS

	8th grade and below	Some High School	High School Degree	Some College	College Degree
Father n = 96	37%	22%	31%	8%	2%
Mother n = 106	20%	39%	26%	11%	4%
Grandparents					
Mat.G.M. n = 83	48%	19%	25%	5%	3%
Mat.G.F. n = 75	59%	15%	17%	4%	5%
Pat.G.M. n = 61	53%	18%	21%	3%	5%
Pat.G.F.	60%	14%	19%	4%	3%

TABLE XXXIX

% OF FAMILIES IN VARIOUS ETHNIC GROUPS n = 113

Caucasian	88%
American Indian	10%
Mexican	2%

the national average birth weight than above it. These data, and data about marital duration and number of stepparents are given in Tables XL-XLIII.

43 % of families belonged to no community organizations; 57 % did not participate in any. 23 % had lived in Missoula a year or less; 40 % had moved here during the child's lifetime. 65 % had moved twice or more in the child's 5-year lifetime. 53 % spent less than $75 a month rent. 33 % own or are buying their own homes. These data are presented in Tables XLIV-XLIX.

RELATIONSHIPS AND DISCUSSION

The relationships discussed are based on a combination of evidence, experience and logic. None of these relationships were analyzed for statistical significance due to the nature of the data. For example, eating a large amount of a food may exert an influence a) due to the ingredients in that food, b) due to the food it displaces, or c) due to a vigorous appetite.

Another example is the fact that low rents were associated with higher income levels. This obviously could not be interpreted that sub-standard housing promotes strong blood. However, Andik, Donhoffer and Schmidt (88) found that while young rats at room temperature fed a low protein diet ad lib ate little, did not grow and died; when the same experiment was carried on at 5' instead of 20' the rats not only survived but grew. The additional stress of the cold increased the metabolic rate and the calorie intake: the rats ate more and hence ate more protein. One might deduce that low cost housing is colder, causes increased appetite, and hence higher hemoglobins. Or the high rent low

TABLE XL

% OF PARENTS IN VARIOUS AGE-AT-CONCEPTION RANGES

Age at Conception	15-17 yrs	18-37 yrs	38-41 yrs	42 yrs+
Father, n = 97	1%	83%	7%	9%
Mother, n = 104	5%	89%	4%	2%

TABLE XLI

% OF CHILDREN IN VARIOUS BIRTH-WEIGHT RANGES

Birth Weight	n = 94
5.8 lbs and below	5%
5.9 - 7.3 lbs	50%
7.4 - 8.8 lbs	37%
8.9 lbs +	8%

TABLE XLII

% OF FAMILIES IN VARIOUS RANGES OF MARITAL DURATION

Marital Duration	n = 96
0 - 5 yrs	15%
6 - 15 yrs	68%
16 yrs +	17%

TABLE XLIII

% OF CHILDREN WHO HAVE (OR DO NOT HAVE) A STEPPARENT

No. of Stepparents	n = 94
0	86%
1	14%
2+	0%

TABLE XLIV

% OF FAMILIES BELONGING TO VARIOUS NUMBERS OF COMMUNITY ORGANIZATIONS n=94

No. of Organizations	
0	43%
1	35%
2	15%
3+	7%

TABLE XLV

% OF FAMILIES IN VARIOUS RANGES OF PARTICIPATION IN COMMUNITY ORGANIZATIONS n = 94

Participations Per Month	
0	57%
1 - 3	17%
4 - 6	15%
7+	11%

TABLE XLVI

% OF FAMILIES IN VARIOUS YEARS-IN-COMMUNITY RANGES n = 106

Years in Community	
0	13%
1	10%
2 - 4	17%
5 - 14	20%
15+	40%

TABLE XLVII

% OF FAMILIES REPORTING VARIOUS NUMBERS OF MOVES

	No. of Moves			
Type of Move	0	1	2 - 3	4+
House, n = 95	17%	18%	37%	28%
Community, n = 95	46%	24%	20%	10%

TABLE XLVIII

% OF FAMILIES REPORTING VARIOUS HOUSE PAYMENTS OR RENT

Amount Spent per Month	
0	9%
$1 - $50	14%
$51 - $75	30%
$76 - $100	40%
$101 and above	7%

TABLE XLIX

% OF FAMILIES IN VARIOUS HOUSING CATEGORIES

Renting	66%
Buying	25%
Own	7%
Living with Family or Friend	2%

hemoglobin relationship could be interpreted to indicate that when the family spends more for housing there is less to spend for food, and less meat results in lower hemoglobin levels. Or, with this small sample, it could have no real significance.

Also complicating is the fact that individual requirements for nutrients vary five-fold.

This data was collected with care and merits examination for whatever evidence and insights are offered about poverty.

NO POVERTY SUB-CULTURE

Among these Head Start families there were few generalities that applied to all. There was no evident slum area, no culture of poverty. There were only two instances where two Head Start families lived in the same block. Thus in most cases, the poor lived next door to more affluent neighbors and were aware of middle class values. There was one mother who dropped out of school after the second grade; there were parents who are college graduates. One mother could not read or write; another mother played in the Missoula Symphony Orchestra. Some parents participated in no community activities; one father was president of his school's PTA, and his wife was president of her woman's club. There were four children whose diets provided optimum nutrition; there were children whose diets provided no meat, milk, green vegetables or citrus fruits. Incomes ranged from $900 a year up to two 1966 incomes that were over $10,000 (those families were eligible because one father was disabled, the other father is in jail). Attitudes vary from that of helpless defeat to that of the disabled father who could not bend over but who, sitting down and hunching along the ground, planted and harvested a large garden. One child with an inadequate mother, a deficient diet and substandard housing was given high behavior ratings by her teacher and had an IQ of 102.

THE CONDITION OF A LOW INCOME BUDGET

There are however generalizations that can be made for the majority of families. The vast majority of families were self-sufficient to the extent that they were not dependent upon public funds as of September. All but one employable father were employed. (Some were out of work during the winter, later). There were five disabled fathers that were not working. 17 families were receiving welfare.

However, these Head Start families lived in an unstable equilibrium. 58% had at some time received welfare aid; half of these had received welfare twice or more during their married life. The average family of 6.3 people had an income of $3200. $3200 is $1000 less than that needed to buy necessities. The poverty level, the amount needed to buy necessities, is a national average. It costs more than that to survive in Montana's cold climate with no public transportation, no public medical treatment, no food programs, no elementary school lunches, and no public low income housing. The lack of $1000 means the lack of necessities.

Low income is not only a symptom of poverty; it is a cause. With a low income, choices must be made between necessities. A little more than half the families paid over $75 a month rent; their children had lower hemoglobin levels than those who paid under $75 rent. That difference was not significant, but it is illustrative of the choices: when enough is spent to get adequate housing, there is less to spend on food.

The following budget for the average Head Start family size and income was taken from the Credit Union National Association Budget Service:

BUDGET FOR A FAMILY OF 6, INCOME $3200

Food	$95
Clothing	25
Transportation	25
Health and Insurance	15
Savings	0
Advancement	20
Shelter	45
Household operation	25

Could a Head Start family follow that budget?

HOUSING

About 10% of families paid rents as low as the budgeted $45. Over half paid over $75 -- up to $200. The difference cannot be made up from the money budgeted for household operation: $25 a month does not heat a well-built house in Missoula's blizzards; the wind blows through substandard housing. Money to provide shelter must be taken from other budget items.

TRANSPORTATION

The $25 budgeted was to cover bus fares, car expenses, and car payments. There is no bus service in Missoula. One mother walked 3 miles to work and 3 miles back to earn $1.25/hr. to support her family of 4 children. She was tired, and did not have energy or time to read stories to her children or to prepare inexpensive meals. Still she continued working until January. She could not walk 6 miles a day in sub-zero weather. She could find no job near her home nor any low cost housing near her job. She applied for, and received welfare.

45% of families were in debt an average of about $500 for a car.

HEALTH AND INSURANCE

After the first two months of Head Start, the median attendance was 85%. Absences were primarily sicknesses. Missing almost a day a week of school handicaps the child's education: it is difficult for him to keep up with his class, particularly if he is feeling less than vigorous.

The largest debts were medical: 27% owed over $500; 60% owed over $100 in medical bills. Medical bills were $100 over the average of other bills for welfare families. Since welfare pays medical expenses, these bills must have been incurred before receiving welfare, and undoubtedly sickness contributed to inability to support themselves.

Necessities must be given priorities: the $25 that might have gone into routine check-ups and dental care must go for rent and food. Savings are 0; a severe sickness or series of minor illnesses creates a financial as well as physical crisis. Missoula has no public facilities for medical or dental treatment (except through welfare.) The Missoula City-County Health Department provides many essential services, but not medical treatment. Those loan companies that make high-risk loans charge high rates of interest. The average amount of debt was $722.

CLOTHING

$25 a month does not purchase snow suits, mittens, shoes and boots for a family of 6, even at rummage sales. There are children who cannot attend Head Start classes until warm clothes are provided.

ADVANCEMENT

$20 a month are budgeted for advancement, but typically there are other necessities (food and shelter) that have more immediately urgent priorities.

Lack of education, whether it is a cause of lack of ability or a result of it, is part of the condition of poverty. 59% of fathers and of mothers had not graduated from high school; 37% of fathers had not gone beyond the 8th grade.

While there was only one unemployed father, the majority were underemployed, i.e., incomes were not adequate for supporting families. How does a father or mother of 4 or 5 children get the education or job skills for advancement when the total income is not providing maintenance?

About a third had had decreases in incomes of over $50 a month in the last 5 years. This suggests attempts at higher paid jobs which the father had lost. Several had gone into business for themselves and failed. This suggests an unrealistic assessment of abilities and business conditions.

For many, the combination of lack of education and lack of job opportunity result in a low income regardless of the ability. Women may or may not have as realistic a view of their abilities as men. There seem to be many of them in jobs like waitresses where the adequacy of their assessment of abilities is not tested.

The higher education of the mother was (slightly) associated with lower hemoglobin levels. With a low income, living by standards often promoted by education means sacrificing something else, (food). LeBovit (89) reports supporting evidence: "When income was lower, the college educated wives did least well. It may be that families with a higher education level feel greater need for expenditures on education and cultural items or better clothes or medical care. They may spend more on such things and consequently have less to spend on food."

FAMILY SIZE

The average family was 6.3 persons. The largest family was 15. The father earned $5500. It would have cost $4950 to feed that family according to the Low Cost Food Plan as of September 1967. The mother actually spent $17.50 a week for food, deciding to give priority to building a house rather than to food. She is now one of the enthusiastic supporters of Family Planning Services.

FOOD

The Department of Agriculture estimates that it costs $24 a month to feed each person. The family of 6 would need $144 a month; $95 was budgeted. 70 % of the families spent less than the cost of the Low Cost Food Plan for food; that fit with mothers' reports that 80 % of the children's diets provided less than 2/3 of the recommended allowances in one or more nutrients.

HOME DIETS AND IQ

The amounts of foods reported as typically eaten per week were combined into the four basic food groups. Eggs, meat and legumes were added to form the meat group. Green vegetables, citrus fruits and other fruits and vegetables formed the fruit-vegetable group. The other two groups were enriched cereals and milk.

Meat Group

The average WPPSI score for the 16 children with diets that provided 9 oz. of the meat group or less per week was 93.0 (range 86-106). The 19 children with diets of 28 oz. or more of meat averaged 97.4 IQ (range 87-119).

Fruit-Vegetable Group

The 17 children with diets that provided 6 half cups or less of fruit-vegetables averaged 96.6 IQ (range 78-109). The 14 children with 21 or more cups a week averaged 103.2 (80-125) IQ.

Enriched Cereals and Non-enriched Carbohydrates

The 11 children who had 8-20 oz. of enriched cereals per week averaged 107 points IQ (range 86-125). The 24 with 22-30 oz. enriched cereals a week averaged 93.4 IQ (range 77-115); the 31 with 42 oz and over a week averaged 95.5 IQ (range 75-122). The 17 children whose diets contained 18 oz or less of non-enriched refined carbohydrates (crackers, candy, pop) had an average IQ of 95.4 (range 76-115). Those 10 whose diets contained 60 oz. or more had an average IQ of 93.7 (range 84-119).

Milk Group

The 16 children that drank 6-11 cups of milk a week averaged 100 IQ (range 76-120). The 31 children that drank 21-28 cups a week of milk averaged 94 IQ (range 77-119).

Total Refined Carbohydrates

The enriched cereal and non-enriched carbohydrate groups were combined and called total refined carbohydrates. The 10 children who ate 44 half-cup or 1 oz. servings or less a week averaged 100.1 IQ (range 76-113). The 7 with 46-48 servings a week had an average IQ of 99.7 (range 78-111). The 23 children with 90 or more servings a week had an average IQ of 97.7 (range 77-122).

The amounts of refined carbohydrates were calculated as percentages of the total number of food exchanges. The 19 children whose diets contained 50 % or less refined carbohydrates averaged

IQs of 101.3 (range 77-125). The 20 children whose diets contained 66 % or more refined carbohydrates averaged an IQ of 96.3 (range 84-114).

Least Adequate and Most Adequate Diets

Possibly amounts of carbohydrates reflect not just inadequacies in the carbohydrates but also that carbohydrates have replaced other foods. Hence the least adequate and most adequate diets were calculated in terms of meat, milk and fruits-vegetables, ignoring amounts of carbohydrates.

The most adequate diets were those diets providing 2/3 or above of the LCFP in all three categories of milk, meat group and fruit-vegetable group, i.e., 11 cups or more of milk, 20 oz. or more of meat, eggs and legumes, and 13 or more half-cup servings of fruits-vegetables. The least adequate diets included two categories: those whose diets provided less than 1/6 of the LCFP in any one of meat, milk, or fruit-vegetable groups (3 cups or less of milk, 5 oz. or less of meat, or 3 servings or less of fruit-vegetable groups) or those whose diets provided less than half of the LCFP in any two of the 3 groups (milk, meat and fruit-vegetable). No mothers reported less than 6 cups of milk a week. The average IQ for the 15 with the least adequate diets was 92.4 (77-113 range). The average IQ for the 19 with the most adequate diets was 98.5 (range 75-125).

In the least adequate diets, 63 % of the food exchanges were refined carbohydrates. In the most adequate diets, 55 % were refined carbohydrates.

These data are summarized in Table L.

TABLE L

AVERAGE FALL WPPSI SCORES GROUPED ACCORDING TO FOOD GROUPS IN HOME DIETS

Food Group	Low amount of Food Group	High Amount of Food Group
Meat group	93.0	97.4
Fruit-vegetable group	96.6	103.2
Milk group	100.0	93.9
Enriched cereals	107.1	93.5 (22-30 oz) 95.5 (42 oz+)
Non-enriched carbohydrates	95.4	93.7
Combined enriched and non-enriched carbohydrates	100.1	97.7
Percent of food exchanges that are refined carbohydrates	101.3	96.3
Combined meat-vegetable-milk groups	92.4	98.5

Food Groups, Hemoglobin and Behavior

For most of these Head Start families, there was not enough money, as the money was spent, to buy adequate amounts of meat, citrus fruits and vegetables. Few of the diets that provided adequate amounts of meats also provided adequate amounts of vegetables. With the high value our society places on milk as nearly ideal food for children, mothers may have been motivated to remember and report those days on which the most milk was consumed.

The majority of diets were poor: 75% provided less than 2/3 of the recommended allowances; 80% provided less than 2/3 of the amounts of food groups suggested in the LCFP. There were four diets that met the allowances. There was no typical Head Start diet.

Therefore the effects of specific food groups on behavior must be considered in terms of what nutrient that food supplies, and also what that food is replacing. With foods as with other things money buys, a large amount of one food is associated with a smaller amount of another.

The variety of findings associated with each food group may be explained in terms of each nutrient's physiological role, and the role of the foods it is replacing.

Iron did not change hemoglobin levels, either in the iron tablets given in the classroom or in the iron furnished. With home diets low in meat, the primary source of iron was enriched carbohydrates.

Vitamin C in home diets was not associated with production of hemoglobin. All children at school drank at least four ounces of orange juice daily; most drank 8 - 12 oz. Thus optimum amounts of C were given at school, so vitamin C deficiencies could not have been limiting hemoglobin production.

Amounts of green vegetables in home diets were negatively associated with hemoglobin levels. There was no assurance that deficiencies of vitamin A were remediated at school: many children did not eat more than the minimum 1 spoonful serving of vegetables.

Amounts of meat and eggs in home diets were positively associated with hemoglobin levels. At school many children did not eat more than the minimum serving of meat. Meat was often served in combination with macaroni.

Amounts of refined carbohydrates in home diets were negatively associated with hemoglobin levels. Most children ate large amounts of the fresh hot rolls that the high school that furnished Head Start meals baked daily of surplus commodity flour. Thus the eating of high proportions of refined carbohydrates was often continued in Head Start classroom lunches.

Possibly hemoglobin levels of 10.0 - 12.0 are normal for these children. However, since IQs went down (not significantly) when hemoglobin levels descended to below 12.0 gms% and went up significantly when hemoglobin levels below 12.0 increased, the child probably benefits from higher levels.

Then at low levels, hemoglobin production may have been handicapped by the deficiency of something that is in meat, but not in milk, citrus fruits, refined carbohydrates or those vegetables commonly eaten. It could not have been protein, because milk furnishes a complete protein, and the majority of children did not have a severe protein deficiency. The logical deficiencies are of those nutrients milled out in refining carbohydrates: pyridoxine, folic acid, pantothenic acid and vitamin B_{12}. Deficiencies of pyridoxine, folic acid and vitamin B_{12} result in anemia. Mangay Chung analyzed "poor diets" (comparable to most Head Start diets) and found them deficient in folic acid, pyridoxine, and pantothenic acid. Hence it is possible that these deficiencies occur in many Head Start diets, particularly in those low in meat.

A pyridoxine deficiency would influence formation of serotonin, dopamine and gamma aminobutyric acid, all of which influence the excitability of neurons. A pyridoxine deficiency would then be expected to result in an anemia not corrected by iron, in hyperactivity, short attention span and distractibility, and in a depression that would lower playground activity and perhaps performance on intelligence tests. That was the pattern for those children who ate large amounts of refined carbohydrates and small amounts of meat and eggs.

Green and yellow vegetables supply vitamin A; deficiencies handicap thyroid production. These deficiencies would be associated with lower mental and physical activity: lower hyperactivity as well as lower playground activity and performance on intelligence tests (if slower mentation is measured on intelligence tests). Lower thyroid levels -- slowness of reaction -- could be associated with low distractibility and lack of short attention span. This fits the pattern of relationships found with amounts of green vegetables in home diets.

The pattern of vitamin C (citrus fruits) is less clear. Vitamin C is involved in formation of serotonin and dopa, hence deficiencies might result in distractibility and hyperactivity. However, experimental deficiencies of vitamin C have not been reported to produce marked changes in behavior. The behavior patterns in children with low amounts of vitamin C and citrus fruits was not definite. Vitamin C is involved in adrenocortical function; in what way it is not clear. This could influence ability to react to stress, which could explain the high association of self-expression and quickness of reaction to authority. That is, however, a guess that has little evidence to support it.

Milk is the nearly perfect food for promoting growth. It is not however, a good source of pyridoxine, folic acid, pantothenic acid, B_{12}, vitamin C or iron. Skimmed milk, dried or fresh, is not a good source of vitamin A. Then milk consumed with diets low in meat and green vegetables and high in refined carbohydrates would be expected to be negatively associated with ability to perform on an intelligence test, playground activity, and hyperactivity. This was the pattern found. However, this does not explain the slight positive correlation with attention span. Also, amounts of milk were probably not validly reported.

Most of the diets reported provided the recommended allowances of protein. However, it was not calculated how much was cereal-vegetable protein (with amino-acid imbalance) and how much milk-meat protein. It was not reported whether cereal proteins were eaten alone (without a complete protein), in which case they would not have been utilized as protein. It was not reported whether any proteins were eaten in states of calorie deficiencies, in which case they would have been utilized for energy rather than protein metabolism. However, the possibility of changes in behavior due to protein deficiencies in this group of Head Start children are slight.

Amounts of calories would indicate primarily a vigorous appetite and physical vigor. Thus the calorie intake might be a result of hemoglobin level rather than the cause of it. Calories are evidently associated with mental vigor also, which may be associated with a lack of perseveration. Calories alone do not indicate nutritional adequacy.

The strongest inverse relationships to IQ and behavior were the amounts of refined carbohydrates. This reflects in part the displacement of other foods: those diets lowest in meat, and green vegetables had higher percentages of refined carbohydrates. The inverse relationships are probably not so much due to the high carbohydrate intake as due to the refinement. The highly refined grains and sugars, developed commercially largely because of their resistance to spoilage, are the cheapest sources of calories generally eaten (though oatmeal and rolled wheat are cheaper). But refinement has deprived them of most of the protective elements with which they were naturally endowed. Perhaps enriching bread with thiamin, riboflavin and niacin has given a false assurance about the adequacy of refined cereals for those whose diets provide high proportions of refined cereals and sugars.

Following are summaries of the relationships suggested between food groups and some nutrients with hemoglobin levels, intelligence test scores and teachers' ratings of behavior.

The numbers refer to the differences in number of children having positive (±) or negative (-) relationships. The number in parentheses indicates the total number of children having high and low ratings or IQs. Those with average IQs (90-110) and average ratings (3-5 in a scale of 7) were not counted. All children were included in hemoglobin levels, as above or below 12.5, the national average for 5 year olds. Differences less than 5 were not reported, unless they were one of the three largest (3 positive and 3 negative) differences for that behavior.

In these tables, a high rating indicates positive healthy behavior. Therefore a high rating in hyperactivity indicates a low incidence of hyperactivity.

Meat
(over or under 66% of Low Cost Food Plan)

+12 WPPSI (n = 42)
+12 Perseveration (n = 32)
+9 Lorge Thorndike (n = 47)
+6 Self-expression (n = 42)
+6 Hyperactivity (n = 34)
+4 Hemoglobin (n = 98)
+4 Playground activity (n = 22)
+3 General Motor Coordination (n = 25)
+4 Ability to understand directions (n = 32)
+1 Playground independence
-4 Distractibility (n = 32)
-4 Fine Motor Coordination (n = 24)

Enriched Cereals
(over or under 100% of Low Cost Food Plan)

-16 Hemoglobin
-15 Lorge Thorndike
-15 Classroom independence
-15 Playground independence
-14 WPPSI
-12 Ability to understand directions
-10 Perseveration
-8 Playground activity
-7 Attention span (n = 35)
-6 Hyperactivity
-5 Quickness of reaction to authority
+10 Self expression

Milk (over or under 66 % LCFP)

-23 Lorge Thorndike
-22 WPPSI
-8 Playground activity
-6 Perseveration
-6 Hyperactivity
-4 Ability to understand directions
+6 Self-expression
+5 Attention span
+5 Quickness of reaction to authority

Non-enriched refined carbohydrates
(over or under 133% of the Low Cost Food Plan)

-22 WPPSI
-19 Lorge Thorndike
-22 Ability to Understand Directions
-15 Class independence (n = 33)
-11 Playground independence (n = 31)
-10 Self-expression
-8 Playground activity
-10 Perseveration
-8 Hyperactivity
-5 Classroom activity (n = 23)
-5 Quickness of reaction to authority (n = 47)
-5 General Motor Coordination

Green and yellow vegetables
(over or under 66% of LCFP)

-12 Hemoglobin
-13 Attention span
-10 Distractibility
-7 Quickness of reaction to authority
-6 Fine Motor Coordination
-6 Hyperactivity
+12 Perseveration
+12 Playground activity
+12 WPPSI
+15 Class activity
+21 Lorge Thorndike

Citrus Fruits (over or under 66 % LCFP)

+14 Self-expression
+13 Quickness of reaction to authority
+5 Classroom independence
+2 Distractibility
+2 Hyperactivity
+3 General Motor Coordination

Eggs (over or under 66 % LCFP)

-12 Distractibility
-8 Perseveration
-6 WPPSI
-7 Lorge Thorndike
-5 Attention span
0 Fine Motor Coordination
+3 Playground independence
+5 Classroom independence
+5 Quickness of reaction to authority
+5 Classroom activity
+8 Hemoglobin

Iron
(66% Recommended Allowances)

-11 Hemoglobin
-10 Fine motor coordination
-9 Ability to understand directions
-6 Playground activity
-6 General motor coordination
-5 Lorge Thorndike
-5 Attention span
-5 Distractibility
-5 Self-expression
-2 Classroom independence

Calories
(100% recommended allowances)

+11 Hemoglobin
+13 WPPSI
+10 Perseveration
+6 Hyperactivity
-5 Attention span
-5 Distractibility
-8 Fine motor coordination

Ascorbic acid
(66% recommended allowance)

+11 Lorge Thorndike
+7 WPPSI
+7 Hyperactivity
+7 Attention span
+3 Distractibility
+3 Self-expression
+3 Quickness to react to authority
+4 Motor coordination general
+0 Classroom activity
-2 Playground activity
-15 Hemoglobin

Other Fruits & Vegetables (66% LCFP)

-8 Distractibility
+6 Self-expression
+6 WPPSI

Vitamin A (100% Recommended Allowances)

-13 Hemoglobin
-3 Attention span*
-4 Classroom activity*
-2 Playground activity*
-1 Hyperactivity*
+5 Playground independence
+6 Fine motor coordination
+9 Lorge Thorndike
+9 Perseveration
*Included for comparison with green vegetables

There needs to be further study about the relationships suggested. The evidence for the relationships between behavior and nutrition is based on a small group of children: about 22-47 children had high or low teacher ratings of behavior. That is a small group on which to base the hypothesis that pyridoxine, folic acid, and pantothenic acid deficiencies have contributed to the problems of poverty. Yet the possibility exists.

Teenagers and low income people eat large quantities of refined cereals and sugars. They are exhibiting unrest, malaise, impulsivity and perhaps (admittedly this is from a middle-class, middle-aged point of view) a lack of ability to consider relational, categorical and abstract aspects, to consider with perspective. This unrest has grown since World War II when nutritionists began recommending enriched bread and dry cereal as an acceptable substitute for whole wheat. Certainly the problems of our times are not entirely due to white bread; however, refinement of cereals and sugars may handicap ability to cope with the complex problems among people who eat high proportions of them.

FAMILY INSTABILITY

42 families had no father living in the home. Four fathers were deceased, the others were divorced or separated. 57 % of families had no participation in any community organization by any member of the family. 65 % of families had moved twice or more during the child's five year lifetime. Add to this the fact of being poor and living next door to affluence; the combination is ego-shattering.

Marital counseling might help preserve family units; support in coping with the problems of poverty that are nearly impossible on low incomes is also needed. Certainly the mothers who have inadequate job skills find it difficult to maintain homes without husbands: poverty is the result of an unstable home. However, it is also true that a man with inadequate job skills finds it difficult to maintain a position as head of a large household with dignity: poverty is also the cause of family instability. Contributing to family instability and to inadequate job skills are the apathy, fatigue and irritability that accompany inadequate nutrition.

In this unstable equilibrium, living next door to sometimes critical affluence and finding it impossible to meet the standards of middle class society, it is understandable that children do not always receive the materials, the attention, responsiveness and security necessary for the development of their potential. While the solution of the family's complex problems sometimes requires years, the needs of the children are immediate: five year olds will enter first grade in a few months. The immediate needs of the children require caring, responsive adults, developmental experiences and nourishing foods. These are provided in Head Start classrooms.

Welfare

When families have not the reserves to carry them through times of stress, the supportive services of welfare are necessary. There was no evidence that these services were handicapping. There was no evidence that providing services in times of crises promoted welfare as a way of life. While 57 families had received public assistance at some time during their married life, only 17 of these were receiving aid at the time of this study. Approximately half of those families who had received welfare were families without a father in the home. The one unemployed father whose family was receiving partial assistance from welfare is now participating in a vocational rehabilitation program. There was no evidence that welfare families had lower intelligence or lower hemoglobin levels. They did not have significantly larger families: they had .4 more children. They had less debt than non-welfare families (though higher medical bills). Perhaps they found it more difficult to borrow money.

SUMMARY

A survey was made of 113 Head Start children and their families in Missoula, Montana in September 1967. The survey included home diet, socioeconomic data, performance on intelligence tests, hemoglobin levels, class attendance, height and weight.

Eighty-eight families were self-supporting, i.e., not receiving public assistance. There were five disabled fathers and one unemployed employable father. The total number receiving welfare was 17. Eight Indian families had been brought to Missoula for a prevocational program.

The average income was $3200, the average family was 6.3 persons. Thus the average family had about $1000 less than needed nationally for necessities. There were four home diets that provided the recommended allowances. Eighty percent of the diets provided less than 2/3 recommended allowance in one or more nutrients. That suggests limited financial and physical resources with which to cope with stress. An unstable equilibrium, readily upset by stress was evident: 57 families had received welfare at some time during their married life. The average total debt was $722. The largest debts were for medical bills. The median winter and spring attendance was 86 o/o. There was no husband in 42 homes. There were stepfathers in 7 homes. These indicate stress from lack of money, sickness and family instability.

Five factors make it difficult to define relationships between food and behavior with statistical significance:

1) there is a five-fold difference in individuals' abilities to absorb and utilize nutrients 2) mothers' reports of amounts eaten were subject to many influences 3) the effects of hypothyroidism, hypoglycemia, irritability, excitability and apathy are difficult to differentiate in subjective ratings of behavior 4) high amounts of carbohydrates may have displaced meat and/or vegetables in varying amounts — there was no one consistent food pattern, and 5) when there is not enough money to buy essentials, choices must be made so that purchasing one necessity means doing without another. Thus no one group of factors may be considered by itself.

Therefore the relationships described are supported more by the way they fit into a pattern predicted from results of controlled experiments of deficiencies than by statistical analyses.

The average WPPSI scores associated with large and small amounts of food groups are presented in Table LI. The differences were not statistically significant.

TABLE LI

AVERAGE FALL WPPSI SCORES GROUP ACCORDING TO FOOD GROUPS IN HOME DIETS

Food Group	Low amount of Food Group	High Amount of Food Group
Meat Group	93.0	97.4
Fruit-vegetable Group	96.6	103.2
Milk Group	100.0	93.9
Enriched Cereals	107.1	93.5 (22-30 oz) 95.5 (42 oz+)
Non-enriched Carbohydrates	95.4	93.7
Combined enriched and non-enriched carbohydrates	100.1	97.7
Percent of food exchanges that are refined carbohydrates	101.3	96.3
Combined meat-vegetable-milk groups	92.4	98.5

Refined carbohydrates (white bread, macaroni, crackers, cakes, candy, pop, etc.) constituted over 50 % of the food exchanges in 75 % of the diets, and over 66 % of the food exchanges in 20 % of the home diets.

Iron in home diets was inversely related to hemoglobin levels. For those who ate small amounts of meat, the chief source of iron was enrichment. 60 mg of ferrous sulfate given daily at school for 108 days did not promote hemoglobin production. Amounts of refined carbohydrate and milk were inversely related to hemoglobin levels. Amounts of meat were positively related to hemoglobin levels. While these data were not statistically significant, they do make sense: there may be nutrients in meat that have been refined out of white flour and sugar that are not abundant in milk and that are necessary for hemoglobin production.

A high refined carbohydrate, low meat diet is deficient in pyridoxine, folic acid, vitamin B_{12} and pantothenic acid. Deficiencies of the first three result in anemia. Milk is not as good a source of these particular B vitamins as meat. A diet that is over 66 % refined CHO would produce asymmetric malnutrition similar in some ways to an alcoholic's. Pyridoxine deficiency has been reported in chronic alcoholism as a cause for withdrawal convulsions (90). One of the major causes for macrocytic anemia in alcoholic points to folic acid deficiency (91). Deficiencies of these vitamins could cause these same symptoms among the disadvantaged.

The evidence suggested that high amounts of refined carbohydrates and low amounts of meat were associated with low playground activity, more hyperactivity, and shorter attention span.

Vitamin A deficiencies cause hypothyroidism and hypoglycemia. 22 % of Head Start home diets provided below 2/3 of recommended allowances of vitamin A. Children with small amounts of green vegetables (vitamin A) had lower playground activity, less hyperactivity and longer attention spans.

It would be possible with blood and urine tests to more accurately define each child's nutritional status. Measures could be designed to measure specific aspects of behavior expected to be associated with various nutritional stati. Then relationships between diet and behavior that were suggested by this study could be tested.

Poor diets were prevalent among Head Start children in Missoula. It is suggested that these contribute to the poverty cycle and must be corrected in order for the disadvantaged to gain maximum benefits from improved education and employment opportunities.

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APPENDIX

Keep this information
for reference........

HEAD START
AND
FOOD!!

We plan to do a study this year to find out what is the best possible food program and we are asking for your help.

At Head Start the children have nutritious snacks and a hot lunch every day. In addition, we plan to give the children different extra food supplements (in a capsule) each day. Blood tests will show if these help build up blood.

We will arrange for these routine blood tests which will be given at the Missoula City-County Health Department.

If you or your family doctor have any questions about this study, please feel free to call Mrs. Nancy Munro at the Head Start Office, phone 549-6403.

Thank you for your cooperation.

Nancy Munro, Nutritionist
Project Head Start
215 South Sixth West
Missoula, Montana

Tear Here
....

I have discussed the plan for studying Head Start foods and their relationship to building up blood with __________________.
(interviewer)

I do do not give permission for my child______________________ to take part in this study and to have the necessary blood tests.

NAME__________________________________

ADDRESS_______________________________

DATE__________________________________

Card No.____

DIETARY QUESTIONNAIRE

Date____________

Family Name__________________________ Interviewer________________

Address_______________________________ Head Starter_______________

1. What foods would you like to have served at Head Start?

____

2. What foods do you think do not need to be served at Head Start?

____

3. Can you see any way a Head Start nutritionist might help you?

____

4. What would you like to discuss or do at Head Start foods meetings?

____

5. Number of adults and children in family________________________

5. How much is spent on food each week?_____________(include dairy)

7. Did you breast feed this (Head Starter) baby? yes no

If no, what was the baby fed?_______________________________

8. What foods did he receive at 6 months?___________________________

At 12 months?____

9. At what age was he weaned?________________________________

10. Did he have any feeding problems as an infant?____________________

____

11. Did you change your diet any during pregnancy?____________________

____

12. Do you give your children any special foods? (include vitamins)______

____

13. At what age did your child begin to drink Kool Aid____ Pop____ Cocoa___

Coffee____ Beer____ Other_________

14. What foods did your Head Starter eat yesterday? Day of week________

Meals	Food Items	Amounts, if known	Comments

Breakfast

____

____

____

____

Lunch

____

____

____

____

Supper

____

____

____

____

At other times

____

____

15. How often does your Head Starter eat the following foods?

Food	No. of meals per day	No. of meals per week	Amount
Cereals			
*Dry Cereal			
Corn			
Rice			
Oats			
Wheat Mac, Spag, Ndles			
*Bread			
*Crackers			
Cookies, cakes, sweet rolls, doughnuts			
Other			
Beverages			
Milk, fresh Milk, dried Milk, evaporated			
*Cheese			
Pre-sweetened Kool Aid			
Pop			
Cocoa			
Beer Coffee Tea			
*Juices			
Other			

*Specify Kind (as white or whole wheat bread)

Food No. of meals per day week Amount

Eggs ____________________

Meats (S if stretched with macaroni, in stew)

Fish ____________________

Beef ____________________

Pork ____________________

Liver ____________________

Poultry ____________________

Game ____________________

Other ____________________

Fats and Oils

Salad dressings ____________________

Oleo ____________________

Animal fats
(lard, drippings
saved from cookng) ____________________

Other ____________________

Legumes

Dried beans ____________________

Dried peas ____________________

Peanuts
Peanut Butter ____________________

Other ____________________

Food	No. of meals per day	week	Amount	Remarks

Fruits and Vegetables

Tomatoes___
Spinach___
Carrots___
Parsley___
Lettuce___
Yellow Squash___
Sweet Potatoes___
Green Beans___
Cabbage___
Turnip Tops___
Broccoli___
Brussels Sprouts___
Peas
Onions___
Beets___
Turnips___
Radishes___
White Potatoes___
Other___

Oranges___
Grapefruit___
Lemons, Limes___

Strawberries___
Other berries___
Pineapple___
Melon___
Bananas___
Apples___
Pears___
Peaches___
Apricots___
Plums___
Raisins___
Prunes___

Other___

Miscellaneous

Sugar (on cereal, bread, other foods)___
Jam, Jelly___
Syrup___
Popsicles___
Ice Cream___
Candy___

Food purchased by child______________________________

Food from neighbors, relatives______________________________

Other______________________________

STUDENT'S BEHAVIOR RATING SCALE

CHILD'S NAME________________________

SCHOOL_____________________________

TEACHER____________________________

DATE_______________________________

1. ACTIVITY LEVEL: In his classroom and playground behavior, is the student more active, less active, or about the same as most other students?

Classroom

very inactive	about average	highly active

Playground

very inactive	about average	highly active

2. GENERAL MOTOR COORDINATION: In gross body movements, such as running, jumping, catching, etc., is this student poorly coordinated, about average, or very well coordinated?

very well coordinated	about average	poorly coordinated

3. FINE MOTOR COORDINATION: In activities requiring fine motor control, such as printing, coloring, doing puzzles, picking up and holding objects such as cups, silverware, etc., is this child poorly coordinated, about average, or very well coordinated?

poorly coordinated	about average	very well coordinated

4. REACTION TO AUTHORITY: When you give directions or instructions, is this child quick to react, about average, or very slow to react?

reacts quickly	about average	slow to react

5. ABILITY TO UNDERSTAND DIRECTIONS: Does this child grasp instructions quickly, is he about average, or is he very slow to understand directions?

slow to understand	about average	understands quickly

6. UNDERSTANDING OF DIRECTIONS: When and if this child fails to respond to directions does it appear to be because he

(1) doesn't understand____________
(2) is negative toward authority______________________
(3) other (please explain____________________________

____

____

7. ATTENTION SPAN: In his ability to keep his attention focused on one subject for a prolonged period of time, does this child show a long, short, or about average attention span?

long attention span	about average	very short attention span

8. INDEPENDENCE: Is this child highly dependent on you, about average, or is he quite independent?

In the classroom

very dependent	about average	very independent

On the playground

very dependent	about average	very independent

9. Is there anything about this child's behavior that you view as unusually good, unusually bad, or at all atypical? Please explain briefly.

10. PERSEVERATION: In speaking or in an activity, does this child tend to continue a line of thought or pursue an action long after it has lost its appropriateness?

yes, often	about average	very seldom

11. DISTRACTIBILITY: When this child is involved in an activity or listening to a story or directions, is he distracted by noise or motion?

yes, easily	about average	very seldom

12. SELF-EXPRESSION: In trying to communicate his ideas, feelings, or making his needs known, does this child have difficulty in expressing himself?

yes, often	about average	very seldom

13. HYPERACTIVITY: In general everyday classroom routine, aside from any "special occasion," does this child show unusual activity, "nervousness," by going from one area to another, rarely completing any project?

yes, often	about average	very seldom

SOCIAL HISTORY I

1. Length of residence in community:

2. Occupation of spouse:

3. Family income: 1966___________
1967___________

4. Educational attainments of parents:
Father___________________________
Mother___________________________

5. Birth order of subject:__________

6. Age of natural parents at time of conception of subject:
Father__________
Mother__________

7. Siblings: Number______________________
Sex_________________________

8. Race or ethnicity of family:_________________________________

9. Location of residence:____________________________________

10. Any changes in family residence within the past five years?______

11. Are you paying rent or are you buying your home?______________

12. Occupation of household head:
a. What does he do?____
b. How long has he been doing it?____________________________
c. Last three job descriptions:
1.____
2.____
3.____

13. Significant family income or occupational variations in past five years:

SOCIAL HISTORY II

1. Any changes in family residence within the past five years?___
   House_____no. moves   Community____no. moves

2. Are you paying rent or are you buying your home?_____________
   Amt./mo._____________

3. Occupation of household head:
   a. What does he do?______________________________
   b. How long has he been doing it?____________________
   c. Last three job descriptions:______________________
      1.______________________________________
      2.______________________________________
      3.______________________________________

4. Significant variations in family income or occupation in past five years: (Give approximate amounts within $50/mo.)

5. Amount and kind of family debt:

	None	$1-100	$101-500	$501-1000	over $1000
a. Consumer_______					
b. Solid (investment)___					
c. Medical_______					
d. Car_______					

6. Main occupation of natural grandparents prior to retirement:

7. Educational attainments of grandparents:

	8th gr. or less	Some H.S.	H.S. grad.	Some College	College Grad.
Maternal:					
Mother_______					
Father_______					
Paternal:					
Mother_______					
Father_______					

8. Organizations family belongs to:
   Membership: a.____________Participation (freq/mo)__________
   b.____________ __________
   c.____________ __________

9. Marital History: (Length of time living together)
   a. Natural parents

   b. Subsequent marriages:

10. Welfare History:
    a. None______
    b. Dates:______________________________
       Recipients:__________________________
    c. Reason:_____________________________